Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XLVI. NEW YORK, SATURDAY, SEPTEMBER 2, 1905. No. 10.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....1139 Monadnock Block
PHILADELPHIA OFFICE.....929 Chestnut Street
CLEVELAND OFFICE.....402 Cuyahoga Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION

United States, Canada, Cuba and Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
Great Britain and Ireland.....25 shillings
Germany.....25 marks
France.....31 francs
Single copies.....10 cents

Remittances for foreign subscriptions may be made through our European office. Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies are kept on sale beyond fifteen months from date of issue except in bound volumes.

Copyright, 1905, by McGRAW PUBLISHING CO.

Entered as second-class mail matter at the New York Post Office.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office by 10 a. m. Monday preceding date of issue. New advertisements will be accepted up to noon of Tuesday for the paper dated the following Saturday.

The exact circulation of the Electrical World and Engineer each week is stated in this column. Of this issue **16,000** *copies are printed. Total circulation for* 1905 *to date,* **487,000.**

NEW YORK, SATURDAY, SEPTEMBER 2, 1905.

CONTENTS.

Editorial 373
Long-Distance Telephony in Mexico 376
Lighting Developments in San Francisco 376
The British Telephone Agreement 376
An Everlasting Electrical Fortune 376
A Statue to Franklin in France 377
The Action of the National Reciprocity Convention 377
Convention of League of American Municipalities 377
Lighting and Railway Interests Consolidated in Nevada 377
Municipal Ownership in Australia 378
Convention of International Association of Electricians 378
A Thumbnail Sketch of Mr. Westinghouse 379
Subway Developments in New York Suburbs 380
Current News and Notes 380
Electrical Engineers of the Times.—XXV. Henry Floy 382
Waterside Station No. 2 of the New York Edison Co.—I 383
Prof. Darwin on the Atom 386
Hydro-Electric Developments of the Ontario Power Company.—II 387
Relations of the Central Station with the Public. By W. F. Kingan 389
The Osmium Lamp 390
Regulation of Electric Rates in Massachusetts.—I. By Alton D. Adams 391
Practical Information on Central Station Meters 392
Tests of the Tantalum Lamp 394
Recent Electro-Chemical Developments 395
New York Central Third Rail 396
The Increasing Use of the Fan Motor 397
Plotting Saturation Curves 397
American Trolleys in Manila 397
Illuminating Engineering and Central Stations. By J. R. Cravath 398
New Telephone Patents 399
LETTER TO THE EDITORS:
Efficiency of Spark Coils. By C. A. Carpenter 400
Digest of Current Electrical Literature 400
Intercommunicating Telephones 404
Electrical Equipment for the West Shore Railroad 404
The Manufacture of Electric Automobiles 405
Westinghouse Core Type Transformers 406
Burke Three-Wire Generator 407
Fort Wayne Alternating Current System of Arc Lighting 407
Balancers for Edison Three-Wire System 409
Recent Work with Walrath Gas Engines 409
Use of the Nernst Lamp in Yonkers 410
Electrical Recording Instruments 411
Smith Type of Storage Battery 412
Regrinding Globe Valve 412
Industrial and Commercial News 413
General News of the Week 417
Weekly Record of Electrical Patents 423

CANDLE-POWER RATINGS.

At the recent convention of the Ohio Electrical Association perhaps the most interesting session was that of an afternoon devoted exclusively to consideration of the new incandescent sources of electric light—the Nernst lamp, the graphitized carbon filament and the metallic filament. It was brought out that 250 central stations are now using the Nernst lamp, and data given of some tests of the tantalum filament entirely verify previous highly favorable reports on this lamp. The merits of the several illuminants under discussion led to a rather animated passage of arms between representatives of manufacturing companies; and while the advisability of allowing such discussions on the floor of a convention may as a rule be questioned, we must confess that in this particular instance we are heartily glad that the matter of the relative "practical efficiency" of illuminants for commercial purposes was brought up, for by assisting in focusing attention a great deal of misconception which seems to have gathered around the question of the efficiency of lighting units may finally be cleared up. This misconception has arisen as a result of the radically different ways in which different electrical illuminants have been rated. In scientific work only mean spherical candle-power is used in comparisons. Commercially, the incandescent lamp is nominally rated at its horizontal candle-power, the arc lamp is not rated by candle-power at all, and the Nernst lamp is rated sometimes by vertical or downward candle-power and at other times by mean lower hemispherical candle-power. That is, each lamp is rated so as to conceal its defects in light distribution. The incandescent is weak in light along its axis, the Nernst lamp in one hemisphere, and the arc, in its enclosed form, at least, gives a lower efficiency than it is wise to mention in any discussion dealing in efficiency alone. It is thus no small wonder that there is a "confusion of tongues" when the luminous efficiency of electric lamps comes up for discussion.

There is only one rational way for the comparison of artificial sources of light as to efficiency, and that is on the basis of mean spherical candle-power, measurements being made on the naked source. This method accounts for the total light given off by the source of illumination, and the ratio of the consumption of energy to produce this light, to the total light produced as determined by mean spherical measurement, is the only true efficiency. (Throughout, by the way, and in order not further to confuse the subject, we employ the word efficiency, not in its correct meaning of the ratio of candle-power to watts, but in its commercial meaning as above stated.) By many, however, it is, and perhaps always will be, maintained that this does not furnish a commercial basis for comparing different illuminants, for the reason that in many cases the light in certain directions is wasted so far as practical illumination is concerned; and also that in order to bring out the best practical efficiency, reflectors or globes, or both, are in cases necessary to redirect and diffuse the light. Owing to the variety in shape and surface of globes and reflectors, and the impracticability of testing all of the sources with exactly the same kind of these fittings, it is obvious that so-called efficiencies obtained under so-called "practical" conditions—which conditions in each case are, moreover, subject to different commercial definition—cannot possibly be comparable with each other. Perhaps the best practical solution of the puzzle would be for our prominent central station organizations to agree upon and adopt a definition of commercial candle-power of electric lamps and insist that manufacturers express the efficiencies of lamps according

to the terms of this definition. A precedent for such action was set by the National Electric Light Association in 1894, when it cleared up the muddle of arc light ratings by specifying that a 2,000-cp arc light should be one requiring for its maintenance 450 watts as measured at the electrodes.

It would seem to be entirely fair to the various manufacturers of incandescent lamps if a definition similar to the following were adopted: That the standard commercial efficiency of incandescent lights be expressed by the ratio of the watts as measured at the lamp terminals, to the mean spherical candle-power; and that when efficiencies are given they be accompanied with a specific statement as to whether the light was measured bare or with globes or reflectors, or both, in the latter cases giving a specification of these fittings. Until some action like that proposed above is taken by a body or bodies having sufficient weight to insure their recommendations being observed, the endless discussion of relative efficiency avails nothing, but merely brings into further disrepute the term "efficiency" as applied to incandescent lamps. The effect of such a rating would be to encourage good distribution of light instead of paralyzing it, and one would have the choice between using an illuminant at its face value or redistributing the light to suit his needs. Reflectors and diffusers are necessary to really efficient illumination, and the basic question regarding a lamp from the standpoint of intelligent engineering is the total luminous flux which it puts at the user's disposal, not the light which is given in some direction selected by each maker as most favorable to his product. The mean horizontal candle-power rating answered a good purpose so long as all incandescent lamps were made after the same general plan; but with the advent of the new illuminants it has outlived its usefulness and should be superseded by the only rating that deals out even justice to all illuminants—that based on an integration of the total luminous flux. The American Institute of Electrical Engineers has formally pronounced in favor of rating on the basis of mean spherical candle-power. Steps toward the mean spherical candle-power rating were also taken by the National Electric Light Association some years ago, but there was not then the great diversity in lamps that now exists, and nothing substantial was accomplished. The time now appears ripe for final action.

ILLUMINATION AND COMPETITION.

It has been said a number of times in the past few years, by those whose study of the matter puts them in a position to know, that there is a far greater chance to make important gains in efficiency by proper attention to the engineering of illumination than by efforts directed anywhere else along the line between the boiler room and the consumer of electric light. It has also been pointed out at electric light conventions by some of the foremost men in the business that after all is said and done the principal business of a central station company is that of selling "light." The auditors are altogether too much accustomed to nodding their heads wisely in assent to these statements and letting it go at that, without taking the trouble to go into the matter of illuminating engineering thoroughly and determining in what ways the central station company can secure greater efficiency in the use by the customer of the light produced. The article by Mr. J. R. Cravath, elsewhere in this issue, brings this subject up again, as did also the practical paper on "The Wiring of Residences," by Mr. J. Kermode, read before the recent Ohio Electric Light Association Convention, and published in abstract in our last issue.

The fact of the matter is, it is the business of the central station man in these days of severe competition to see that his customers are getting the most possible for the money they are paying the company for electric lighting service. The central station always has a competitor in the shape of some other illuminant. Although electric light in some cases is at a disadvantage as regards the cost of simply producing a given number of units of light, it is usually possible in these cases with the aid of a knowledge of illuminating engineering to deliver a larger percentage of the light produced as useful light to a customer with electric light than with other illuminants, so that electric light can be put on more nearly the same footing as to cost.

It is notable that the companies which give most attention to customers' installations are usually the ones which have made the greatest success of the lighting business. The central station manager who sits down with a long face and says that customers will not take the advice of the company in lighting matters because they think the suggestions are made with some ulterior motive, is often, we fear, one whose suggestions have been such as to give customers cause for suspicion. Nothing can win a customer's confidence and friendship more than pointers on the part of the company as to methods by which he can economize in the use of light, or get more for the same money. It is not possible, especially in large cities, for the central station company to keep close watch of the installations of every customer, but it has been demonstrated that in all but the largest cities the company can, by continued effort, establish a precedent that its advice be sought on matters of illumination before the electric lighting of any place is planned. This does not mean that the actual work of wiring is to be taken out of the hands of the local wiring contractors, but that the company cannot afford to ignore what is going on beyond the service switches. Until such time as architects seek the aid of illuminating engineers, the central station company must itself look out for these matters, or at best throw its influence in that direction.

LIGHTNING.

Talk as you please of the vast progress made in electrical appliances, and chuckle as you may over the prospects of this twentieth century, there is one device that looms grimly and reproachfully out of the neglected shadows of the past. We refer to the lightning rod, which is to-day substantially in that state of development in which it was left some years since by the late B. Franklin, F.R.S. In spite of all the erudite researches since his day our knowledge of the actual character of lightning has not greatly advanced. It is high time that the one form of electrical energy which does not have to be paid for by meter or otherwise were studied with its own thoroughness. There have been many speculations about it and a few experimental investigations, but none in the least commensurate with the importance of the subject. Not only is lightning the cause of great actual destruction of life and property, but it seems to have a grudge of long standing against electrical systems in general, and is to-day one of the most formidable difficulties in the way of electric lighting and power enterprises. One installs lightning arresters of course and hopes that they may do some good, and they are a needed safeguard; but one feels very much more comfortable after the storm blows over leaving the lines and transformers still intact.

We have rather come to the opinion that the chief trouble with the lightning arrester question is still lack of knowledge regarding the thing which is to be arrested. We all assume and probably correctly, that lightning being in the nature of a condensed discharge, is essentially oscillatory in its nature. The virtual capacity involved and hence the frequency is an unknown quantity, like the potential concerned in the discharge. It is certain that lightning flashes

sweep over very great distances ranging from a few hundred feet up to several thousand, but the voltage from which these prodigious striking distances result cannot yet be evaluated. If the nearly linear relation connecting voltage and striking distance within experimental data holds under the conditions found in the heavens, one would have to estimate the voltage of a thousand-foot flash at 100,000,000 volts or thereabouts. But the experiments reach with certainty only about 500,000 volts, and how things go far beyond that nobody knows. Nor can one more than guess at the nature of the discharge. On rare occasions an apparently simultaneous volley of flashes is seen between clouds that would apparently indicate a violently oscillatory discharge, while more commonly one sees isolated flashes, likely enough still oscillatory, but with a totally unknown rate of damping. If the damping is sufficient to reduce the discharge practically to a single rush, then what is the gradient of the wave front which determines its virtual frequency? Some of these questions may be at least approximately answered by a photographic study of flashes, perhaps with the aid of rotating mirrors; and such a study conducted at two adjacent stations would certainly disclose some valuable data as to the dimensions and position of lightning flashes.

It would certainly have a considerable scientific value, which is itself a sufficient reason for undertaking it, and it is by no means improbable that information of a very practical value might be the outcome. Present devices for the protection of apparatus and lines against lightning are based on the conception of lightning as a rapidly oscillatory discharge. It is possible, however, that some lightning at least may have a pretty slow period, or may be damped into virtually a single rush, of a sort which cannot readily be choked back. Certainly lightning is of an immensely variable character, so that generalizations regarding it are altogether unsafe. The trouble with the experimental study of lightning is the comparative rarity of lightning itself at any one station, a rarity that for practical purposes is increased nearly three-fold by the shortness during the lightning season, of the hours of darkness during which a photographic method could be applied. It strikes us that the damage done annually by lightning is sufficient to justify the Weather Bureau in undertaking some such systematic investigation of the subject as might lead to better preventive measures. There is just the sort of persistent attention required that it is extremely difficult to obtain save with professional observers who can be on the watch without being called off by other duties. With work intelligently distributed among the various stations a few years would see the accumulation of a great deal of valuable information without any very great expense. If the work led to the prevention of even a small percentage of the damage annually done by lightning it would pay merely as a matter of business. It is particularly a matter for the government to take up on account of the public nature of the service, and the comparatively small opportunities of any single private observer or group of observers.

RADIO-ACTIVE MATTER IN THE ATMOSPHERE.

A recent paper in the *Philosophical Magazine* by A. S. Eve, describes a research at McGill University to determine the number of ions in the air of that neighborhood, with a view to ascertaining how much radium would be necessary at or near the surface of the earth in order to produce a like number. The air of the physical department at McGill University is unfit for such experiments, owing to the scattered presence of radioactive substances in all parts of the building; but the engineering department building was considered as untainted by abnormal radioactive matter. An empty water tank in this building, 8 meters high and 1½ meters square, of iron 3.5 cms. thick, was selected for the experiment. A carefully insulated wire was suspended in air in this tank for three hours at a time, while maintained negatively electrified to a potential of about 10 kilovolts by an active influence machine. At the end of this time the wire was removed and found to be radioactive, as determined from its charge-dissipating properties. By comparing the radioactivity with that produced in a zinc cylinder containing air exposed to radium emanation, it was finally deduced that the air within the empty water tank was as active as though it had contained half a gramme of radium bromide per cubic kilometre. The ionizing properties of the air in the tank and in the building were found to be of the same order of magnitude as those of air taken outside the building.

The deductions from the measurements are of much interest. If the atmosphere covering the land surface of the earth is as active from an ionic standpoint as the air in Montreal, for an elevation of a kilometre, 600 tons of radium bromide evenly distributed over that surface would continue to produce emanation sufficient to equal in its effects those observed in this case. Moreover, if radium salts occur distributed uniformly in the crust of the earth to an extent sufficient to account for the observed temperature gradient in the earth, the layer of surface soil containing this small proportion of radium, sufficient to ionize the air to the observed extent, would be only a few metres thick. The number of ions constantly being produced in the atmosphere by the earth's radium, or other causes, is reckoned from these observations to be approximately 10 ions per second per cubic centimetre, an estimate which agrees satisfactorily with those made from similar observations in other localities. It seems very desirable that the experiments described should be repeated in numerous localities over the globe, both on land and sea, in order to ascertain whether the ionizing properties of the atmosphere are uniformly distributed; or whether they vary from one region to another.

In the light of these and similar experimental results, it is easy to understand why the harvest of researches into the electric properties of the atmosphere has hitherto failed to show any clear relation to the state of the weather. If the earth is constantly exuding an ionizing emanation, then the superincumbent layers of air will be electrified from below by the ions liberated under the influence of this emanation. An electrometer brought into electric communication with the surrounding outdoor air by a burning match, or a water atomizer, will acquire a charge due to the earth-borne material, and not due to aerial movements except in so far as these may disturb the natural disengagement of ions. Again, it seems clear that in the case of an aerial insulated conductor such as a telegraph wire, its apparent defect in insulation will be attributable to free ions in the surrounding air, independently of the leakage over the surfaces of the glass or porcelain insulators. The movement of ion-laden air past the wire in transverse winds should also be expected to vary the insulation leakage. The ordinary telegraph wire is too poorly insulated at its supports or contacts to render such observations of much value, but lengths of aerial wire insulated with care, on oil insulators, might afford important material for scientific investigation. These atmospheric ions have so recently become recognized that there has not been time to determine their influence upon natural laws. It is quite possible that they may exert an appreciable effect in the production of rain or take some share in the activities of the organic world. A large amount of patient investigation will doubtless be necessary before such questions can be answered; meanwhile, although we must be prepared to accept beliefs cautiously, we must also be ready to bid farewell to all surprise, so wonderful have been the electric revelations of the past decades.

Long Distance Telephony in Mexico.

The city of Torreon, Mexico, is to be made the central point for an extensive system of long-distance telephone lines which are to cover a large portion of Northern Mexico. The concession for this proposed system was obtained from the Mexican Government about three years ago by John Woessner, an American resident of Saltillo, Mexico. At the present there are two independent telephone systems in Torreon, each of them having large lists of subscribers. Both systems were recently improved in many particulars. Mr. Woessner already has built long-distance lines from Torreon to Gomez, Palacio and Lerdo, and to the more distant city of Durango. Mr. Woessner says that one of the most important points which he desires to reach is Monterey, and the matter of extending the system to that place is now under consideration with every prospect that it will be carried into effect. The distance is about 200 miles. Mr. Woessner stated further that if the negotiations now pending are consummated so as to obtain an entrance into Monterey, the work of construction will soon be begun and that the line will be completed and ready for operation in about three months. One of the systems in Torreon is operated by Mr. Woessner in connection with his long-distance lines. He has installed the most up-to-date equipment in the local exchange. Many of the leading ranchmen of this part of Mexico have urged Mr. Woessner to extend his system to their places and this may be done. Some of the ranches are already connected with Torreon by private lines and these may in time be taken over by the Woessner system. Some of the richest country in the Laguna valley will be embraced in the territory covered by the lines of the long-distance telephone system and the people who live upon these plantations will be placed in direct communication with all of the markets of Northern Mexico.

An extensive system of independent long-distance telephone lines centering at Chiguahuapan and extending to the capitals of all of the districts of the State of Puebla was formally inaugurated a few days ago. An independent telephone line from Cholula to Acatepec, in the same State, has been placed in operation.

Lighting Developments in San Francisco.

The lighting situation in San Francisco is still influenced by consolidation rumors, many indications being to the effect that the California Gas & Electric Corporation will dominate the merger. The San Francisco Gas & Electric Company's stock has advanced during August from $62 to $77 per share on reports that there was an offer for the entire holdings at a high figure. While it is said that the California Gas & Electric Corporation made a standing offer for the San Francisco Gas & Electric Company for a long period, other propositions have been made. Mr. Edwin Hawley, who is close to the Western Pacific Railway Company, has been credited with a connection with one of the offers and F. H. Ray, who appraised the Gas & Electric Company's plant is supposed to have acted in his interest. Just where the San Francisco Coke & Gas Company will come in, if at all, cannot be said at present. It has just begun operations giving the first competition in gas lighting for several years. It has been asserted that Standard Oil interests are behind this concern, which has sold bonds to the amount of $2,500,000. It has been reported that this company is not desirous of selling out, but would sell if a high figure were offered, or it would undertake to buy out the other companies under certain conditions. There is a possibility of the Mutual Electric Light Company selling out, but as its business has been increasing and its new plant is showing great economy in operation, many of the stockholders prefer to have it remain independent. While it is not at all certain that the present negotiations will result in a sale when submitted to a vote of the San Francisco Gas & Electric Company's stockholders, the field is a very attractive one and large capital might be profitably employed if it were properly covered with modern gas and electric plants. Although the California Gas & Electric Corporation has not admitted that it will distribute gas in San Francisco, it is significant that its gas engine reserve plant, which is nearly completed six miles from the city, will use illuminating instead of producer gas. The works are laid out so as to permit of increasing the capacity six-fold when desired, and by use of high pressure the city could be supplied.

The British Telephone Agreement.

The report of the Select Committee on the agreement between the National Telephone Company and the Postmaster-General has been issued. It recommends that, with certain modifications and provisions urged by the Committee, in the general public interest the agreement should be approved by the House of Commons. If this approved be given, the agreement will come into force on August 31 of this year, and the transference of the National Telephone service to the State will take place on the last day of the year 1911.

With regard to the treatment of the National Company's employees after the transference, the committee propose that all officers and servants who shall have been not less than two years continuously in the service of the company on December 31, 1911, shall as from that date become officers and servants of the Postmaster-General on the terms of hiring and conditions of employment which obtain in the grade to which they are transferred.

The committee recommend an undertaking by the Postmaster-General that no servant of the company taken over by the Post-Office shall suffer by the transfer whenever it takes place; and that the employees of the company shall have the option of either continuing on the same terms as to pensions which they now enjoy under the company, or of adopting the superannuation terms and conditions of the Post-Office service. The committee do not think that the coming into operation of the agreement will place the staff in any worse position than that in which they stood on February 2, 1905.

An Everlasting Electrical Fortune.

We are glad to give prominence to the accompanying extraordinary announcement of the Joyce Manufacturing Company, of Columbia, of which John Joyce, Macdowall, Saskatchewan, Canada, is president. The matter appears as an advertisement in the New York daily papers:

"Wanted.—Vice-president for above company; must deposit $5,000; will receive 50,000 shares fully paid up and non-assessable stock, besides wages and emoluments, and double your money back in three months. This is a good, safe opportunity of one million a year, as you have world-wide monopoly.

"This company is formed for the purpose of manufacturing patented machinery in its own factories in all parts of the world. It has several lines of patented machinery as well as a power electric engine. This is a perpetual power engine. I have a small working engine in my workshop. I mean just what I say. I have also a land and water vehicle. This will push all automobiles out of the market. The inventor has sold all these inventions to the company for one million two hundred thousand shares, which leaves eight hundred thousand to be sold to stockholders, of which one hundred thousand shares have been sold. There are still fifty thousand shares to be sold at the present price, which is one hundred dollars for one hundred shares. No more will be sold at that price. Now, if you have one hundred dollars, this is the time to grasp a competency for life and your heirs after you, for when our factories are established in all parts of the world you may depend on it dividends will net you in yearly twenty times the amount of what you paid in, namely, two thousand yearly. This is no wildcat scheme, but a bona fide world-wide monopoly that will outrival any steel trust or railway corporation. There is no watered stock, neither will there be any preferred stock, nor any such nonsense as selling and buying on margins; that the shares will rise to thirty or forty dollars a share is quite probable before these six hundred thousand shares are sold. But remember no less than one hundred shares sold on one certificate. We have no debts in this company; neither do we intend to contract any if possible. Shares will remain at 2,000,000 for all time. It will be the business of the directors, whoever they may be, when they see a good invention of meritorious points placed on the market, to buy into the company so that the monopoly will still remain in the company ad infinitum. For investigation write to the president or call at Manufacturers & Inventors' Electric Co., 82 Nassau Street, or at the head office, directed on head lines of this adv. For position of Vice-President or for shares in the company call at head office or write to ———."

A Statue to Franklin in Paris.

When the 200th anniversary of the birth of Benjamin Franklin is celebrated, on January 17, 1906, the kindly regard in which the memory of the first American Minister to France is held in Paris will be shown, says the New York *Tribune*, by the dedication of a bronze statue of Franklin, given to the city by John H. Harjes, at present the resident member in Paris of the firm of Morgan, Harjes & Co. The statue, which will be a replica of the one in front of the Philadelphia Post-Office, will be placed in the small, grass-covered plot in the Rue Franklin, near the Place du Trocadero and just in front of the Trocadero Palace, which has been given for that purpose by the Municipal Council of Paris. The pedestal will differ from the one supporting the figure at Philadelphia, which has been deemed too massive for the site to be occupied in Paris.

As early as May 23 last Mr. Harjes formulated his offer to M. J. Bouvard, administrative director of the services of architecture and promenades of the city of Paris, and, after some negotiation in June last, addressed M. Delcasse, then Minister of Foreign Affairs, asking him to use his influence toward expediting matters on account of the shortness of time before the anniversary. This letter, written the day before M. Delcasse resigned, was answered by M. Rouvier, his successor, in an exceedingly friendly spirit and conveying the necessary favorable report. As time was precious, Mr. Harjes had anticipated a favorable answer by cabling to John J. Boyle, the New York sculptor, who produced the Philadelphia statue, giving him instructions to begin work at once on the replica. Since then Mr. Harjes has received word from the sculptor that the statue will be delivered at Havre by December 15 next. It was originally intended that the gift should come from the citizens of Philadelphia, and an attempt was made to have it presented under the auspices of the University of Pennsylvania, but little progress was made, and the plan was finally abandoned.

In speaking of this, James M. Beck, who made an oration at the dedication in Philadelphia, on June 14, 1899, said a few days ago: "The delay in realizing this project has had at least one advantage, in that the statute will now be erected at a time when the entire world will commemorate the 200th anniversary of Franklin's birth; and it will fortunately come at a time when the relations between France and the United States are exceptionally cordial. The historic link that binds the two countries together has already been marked by statues of Washington and Lafayette, which have been erected in the city of Paris as the gift of American citizens; but these expressions of our good feeling would be deficient if no statue were erected in Paris of Franklin, who lived for nine years at Passy, and whose diplomatic work at Paris with the French government made the success of the Revolution a possibility."

The Action of the National Reciprocity Convention.

The following "platform" or series of resolutions was adopted by the recent national reciprocity convention at Chicago, attended by about 800 delegates and commercial or agricultural representatives.

The National Reciprocity Convention, representing more than 200 agricultural, commercial and industrial associations of the United States, by delegates assembled at Chicago August 16 and 17, 1905, hereby makes the following declaration of principles:

Whereas, The agriculture, manufactures and other industries of this country have expanded to such an extent that they can no longer depend upon the home market for the consumption of their entire product; and

Whereas, The export trade has become a vital support to many of our industries; and

Whereas, The present commercial attitude of the United States, largely owing to our failure to carry into effect the reciprocal trade provisions of Section 4 of the Dingley law, is antagonizing foreign nations, whose good will we desire and on whom we have hitherto depended as purchasers of our surplus products; therefore, be it

Resolved, First, that this convention, recognizing the principle of protection as the established policy of our country, advocates immediate reciprocal concessions by means of a dual or maximum and minimum tariff as the only practical method of relieving at this time the strained situation with which we are now confronted;

Second, that eventually the question of the schedules and items to be considered in reciprocal concessions be suggested by a permanent tariff commission, to be created by Congress and appointed by the President, which shall consist of economic, industrial and commercial experts;

Third, that it is the sense of this convention that our present tariff affords abundant opportunity for such concessions without injury to industry, trade or the wages of labor.

Fourth, that we urge action upon Congress at the earliest time possible.

Convention of League of American Municipalities.

Five hundred delegates, representing cities and towns in all sections of the country, were present on August 23 at Toledo, O., at the opening session of the ninth annual convention of the League of American Municipalities. Mayor Finch of Toledo welcomed the delegates, and the response was made by Mayor Crolius of Joliet, Ill., president of the league. The president's annual address was the feature of the first session, and dealt with the achievements of the league and its opportunities for future usefulness. The report of Secretary MacVicar shows all expenses paid and a balance in the hands of the treasurer. The receipts for the year were shown to have been $2,500.

At the afternoon session, Charles Hague of New York City addressed the convention on "Fire Department Water Supply," J. W. Wood, chief engineer of St. Louis, spoke on "St. Louis's Municipal Lighting Plant," and "Street Cleaning" was discussed by Mayor Silas Cook, of East St. Louis, Ill. In the evening Peter Witt, city clerk of Cleveland, spoke on "How to Tax Real Estate," and "The Abatement of the Smoke Nuisance" was treated by Smoke Inspector King, of Indianapolis.

Municipal ownership of public utilities was the question which aroused earnest discussion. The conflict of views among the members, made apparent by the initial discussion, was intensified by Mayor Dunne of Chicago, whose speech in defence of municipal ownership was the feature of the session. Mr. Dunne covered all the points in favor of public ownership, which he advocated in his recent campaign for mayor, and he expressed himself as being firm in the belief that the people of his city, along with citizens of other cities, should own and control these public utilities. When asked how soon he expected to secure public ownership in Chicago, he replied that he did not know, that the question had been presented by him to Council nearly two months ago, but that no action has been taken, and that he is powerless to do anything without the co-operation of Council.

Mayor Woodward of Atlanta, who led the fight against municipal ownership, replied to Mr. Dunne, holding that private ownership of utilities, properly controlled, is of greater public benefit than if owned by municipalities.

Lighting and Railway Interests Consolidated in Nevada.

The Nevada Power, Light & Water Company is the name of the new company combining the lighting, railway and water interests in Reno, Nevada. The company has $1,000,000 capital stock and $750,000 bonds, $300,000 of which are reserved for the purpose of retiring a like amount of the Nevada Power, Light & Water Company 6 per cent bonds. The 6 per cent sinking fund bonds now offered have been issued in order to acquire a controlling interest in the Washoe Power & Development Company and in the Nevada Transit Company.

There are no bonds against either of these companies and none can be issued in the future. The Reno Power, Light & Water Company owns the water works supplying the cities of Reno and Sparks (combined population 15,000), water power plant, electric light plant, gas plant, ice plant and cold storage plant, all of which supply the two cities named. In addition it owns about 5,000 acres of land in and about the city of Reno, susceptible to irrigation. This land is valued at $30 per acre, or $150,000. Of the properties to be acquired the Washoe Development Company owns a power plant

located on the Truckee River, the only available power site left within a radius of 250 miles. The Nevada Transit Company operates an electric railway connecting the two cities of Reno and Sparks, which are about four miles distant. The Washoe company is acquired on a basis of $225,000, and the Nevada company on a basis of $100,000. The proceeds of the bonds will be used entirely in payment of the stock of these two companies. An estimate of the value of the Reno Power, Light & Water Company properties before acquiring the two companies named was $806,424, against which $512,000 bonds are issued. This value does not include water rights and franchises. The gross earnings of the company for the year ended March 31, 1905, were $156,597, and the operating expenses $61,653. The net earnings were $94,943. The total interest charges on $512,000 were $30,720. It is expected that the acquisition of the two companies named will increase the net earnings of the company at least $40,000 per annum, making total net earnings of about $135,000, against which the interest charge on the entire $750,000 bonds will be $45,000.

Municipal Ownership in Australia.

Mr. W. J. Sowden, editor and proprietor of the Adelaide (South Australia) *Register, Journal and Observer,* who is a commissioner of his government sent here and to other countries, has made some interesting remarks recently on the effects of government and municipal ownership. Mr. Sowden is president of the national reform political organization, which is to the general government what the Citizens' Union is to the municipality of New York. "We have had a sad experience with government ownership," said Mr. Sowden, who is quartered at the Hotel Manhattan. "Nearly all of our public utilities are administered by government, with the result that politics dominate them and the public service is woefully misadministered. Not all of the tramways are in the hands of the government, but with the slovenly example of the government railroads and government tramways to copy we find ourselves in a sad way.

"To begin with, the service is controlled by the premiers of the various provinces, who represent the dominant political parties and run the railroads largely as personal political properties. The roads do not pay properly, the tariffs on passengers and goods are high compared with yours, and the employes, having life posts, are not amenable to discipline or to public sentiment. The eight-hour law is in force everywhere.

"What is true of the government roads is true of the government telephone and telegraph lines, which are not managed with the efficiency and economy of your private corporations. I notice that our government institutions require more employes than your private enterprises; there is no question that wasteful and extravagant practices obtain. We are constantly confronted with radical demands by the socialists. Our socialists differ from your socialists. They demand the nationalizing or taking over by the government of all public and semi-public enterprises. Consequently, manufacturing and other private industries are threatened, capital is timorous and the people are in a state of unrest.

"These socialists want every avenue of activity administered by the state. They are advanced labor agitators, in a measure, and they are reactionary. The result of their agitation is to send up the rate of interest on public and private loans, and it is a fact that British capital is loaned to Canadians at an average of one per cent less than to us. Because of this unrest and lack of faith in the future our people are letting their savings lie at a low rate of interest in the savings banks, instead of using them in extending business.

"The socialists, for instance, induced the government to go into the refrigerating business, and in Adelaide a sheep freezing plant for export meat was established. The government has even gone into the locomotive building business, with the result that private and corporate industry in that line has been throttled. The employes of this plant openly went so far as to suppress activity on the part of the workers, admonishing apprentices that they must do as little as possible, doing what they did as slowly and badly as they could. They even had rules and regulations limiting the amount of a workman's effort. So flagrant did the reactionary and disorganizing policy become that Judge Gordon, on the floor of Parliament, denounced the practice, with the result that a law was passed which in a measure restored the activities of the plant."

Convention of International Association of Municipal Electricians.

The tenth annual convention of the International Association of Municipal Electricians was held at the Reed House, Erie, Pa., August 23, 24 and 25. Mr. Walter M. Petty, the president, called the meeting to order at 10 a.m., and after a prayer by Rev. A. C. Ellis, Hon. R. J. Saltsman, Mayor of Erie, made an address of welcome. In this the Mayor referred to the points of interest in Erie, some of which points had historical significance. He extended the freedom of the city to the members and their friends, especially the ladies.

Responding for the association, Mr. J. B. Yeakle, of Baltimore, thanked his honor for the kindly words of welcome and also congratulated the city upon its pleasant location on the shores of Lake Erie, and its many beautiful homes.

Mr. Petty, the president, then delivered his address, the theme of which was "Suggestions as to Increasing Our Membership and Adding to Its Value." Mr. Petty suggested the division of the association into sections, each devoted to some particular branch of municipal electrical engineering. Several other schemes for making the work more valuable were advanced.

The first paper on the programme considered at the afternoon session was that by Capt. William Brophy, of Boston, Mass., which, in the absence of the author, was abstracted by Mr. Yeakle. After discussing the various details of fire alarm telegraph systems, the paper stated that 98 per cent of the failures of fire alarm systems are due to the circuits, and that the present overhead system was characterized as a relic of barbarism that should be discouraged by every fire alarm superintendent who values his reputation or has the interest of those he serves at heart. All overhead circuits should be insulated with the best known material, and this in turn covered with a protection from the elements, abrasion, etc. As to cables, these should also be of the highest quality, and the practice of installing cables in conduits also used by other classes of cables was characterized as an outrageous abuse. Some of the old underground cables have proved to be utterly unreliable. In some cases the imperfect operation of cables is not wholly due to inherent defects and to the ignorance, dishonesty, rascality and graft of those who purchase them, but also in a measure to the ignorance, carelessness and neglect of those who have had charge of them. Duplicate or triplicate operating stations are advocated, in order that the destruction of one shall not affect the operation of the whole fire alarm service. Even if in a fire-proof structure, operation is menaced by lighting and high-voltage dynamo currents. In a large city like Boston, sub-stations should be established in various localities. In New York there should be two or more operating stations placed midway between the ends of the city and the main central office. The system of interlacing circuits is only a partial remedy for open circuits or grounds for the reason that the average citizen and many of the police force would go to another nearby box on a different circuit.

The discussion which followed was participated in by Messrs. Yeakle, Murphy, Foster, Hatch, Thompson, Berry and others. There were expressed ideas showing that many believe in the bare wires for fire and police telegraph systems. Many also differed with Capt. Brophy in his opinion that more than one central office is advisable.

Following Capt. Brophy's paper was read one by Mr. C. E. Diehl, on "The Advisability or Inadvisability of Fusing Fire and Police Telegraph Boxes." Mr. Diehl's conclusions were that fuses in these boxes would prove more of a nuisance and danger than a protection. The modern box is now equipped with a cut-out device that permits its introduction into the circuit only when it is required, and if the line and instruments at central offices are protected by fuses it is not necessary or advisable to have fuses in the boxes. The concensus of opinion agreed with Mr. Diehl.

Mr. Louis Gascoigne, of Detroit, then read his paper on "Underground Construction." After discussing the several types of underground conduit, Mr. Gascoigne stated that an experience extending over eighteen years had led him to favor iron pipe, which, if properly treated, will last indefinitely. The cost for excavation is considerably lessened with such conduit, it can be laid in a narrower trench and long sections can be laid at one time. While the cost of clay conduit is only 5 cents a foot, to lay it costs 22 cents per six-duct foot; and while the cost of 2-in. iron pipe is 12 cents a foot, six 2-in. iron pipes can be laid for about 18 cents. Insulated paper

cables, lead-covered, were approved, but for fire alarm and municipal telephone purposes all conductors should be in twisted pairs and of a size that may be used for either purpose. He considered that conduits should be constructed by municipalities and rented to all companies. The greater part of the paper is confined to a consideration of the subject of municipal electric lighting, three cases being considered, one that of a small village, another of a large city and the third that of the Detroit municipal plant. In the case of the village, which has a population of 1,200, estimates were secured for the cost of a plant for 26 arcs and 500 incandescent lamps, but it was concluded that it would be more advisable to enter into a contract to light the streets with acetylene gas lamps, which was done. The second case was that of a city with a population of 125,000 people, which has a plant built for 2,000 street lamps, there being no commercial service. Merely the data of this plant and the investment, operating and other costs are given. The Detroit plant is described in very full detail and the history of its management given from the beginning. The management of the plant is severely arraigned, and the conclusion arrived at that while the plant has nearly paid for itself in the past eleven years, there is a large expense in the near future, and the secret of what success it has met has been due to the fact that it has not attempted to give commercial service.

Discussing the paper, some members stated that iron pipe was subject to corrosion and no amount of treatment could remedy this. Messrs. Murphy, Bosch, Allensworth and Thompson also discussed the paper.

After an adjournment for luncheon, the paper by Mr. C. L. Williams, of Laurel, Miss., entitled "Erection and Maintenance of Electric Lighting Plants," was read by title. The paper considered the subjects under the heads of depreciation, building fuel, labor, boilers and engines. This paper was awarded the "Medal of Merit" by the association. The paper is based upon data received from central stations throughout the United States of small capacities employing only overhead circuits. An abstract of this paper will be printed in another issue.

The next paper read was that by Mr. A. L. Hatch, of Detroit, Mich., entitled "Electric Light Engineering." This was discussed by Messrs. Cambridge, of Columbia, Mont.; O'Hearn, of Cambridge, Mass., and several others. The discussion brought out the very great differences that exist in the charges for electric lighting in different places.

At the opening of the morning session of August 24, a paper by Mr. T. C. O'Hearn, of Cambridge, Mass., was read by the author. The title of the paper was "The Need of a Rigid Inspection by the Municipality." Messrs. Thompson, Hatch, Yeakle, Petty, Donohue and Foster discussed the paper, the opinions being almost unanimous that it was the function of the municipality to inspect and control all wiring.

In connection with the discussion the report of the representation to the National Conference on Standard Electrical Rules was received and discussed, and the secretary was instructed to send out notices to the members requesting their criticisms and suggestions upon the latest issue of the insurance code.

Following this discussion the paper by Mr. H. R. Allensworth, of Columbus, Ohio, entitled "The Effects of Electrostatic Influence in Telephone and Telegraph Circuits" was read. After setting forth the principles of electrostatic induction, the effect on telephone and telegraph circuits was considered and remedies suggested for counteracting troubles from electrostatic effects. The paper was discussed by Messrs. O'Hearn, Hatch and Gascoigne.

At the conclusion of the discussion the members visited the Burke Electrical Works, which were inspected under the guidance of Mr. Burke and others of the company. At 9.30 a.m., on August 23, the "Question Box" was taken up and several queries were answered and discussed.

Following this came the reports of officers and committees. The treasurer's report was received with great applause, it showing the finances to be in a very healthy condition. New Haven, Conn., was selected as the place for the next convention.

The names of the officers-elect are given below. To each member of the Executive Committee was assigned responsibility for a branch of the work of the association, as noted in parentheses. President, Jerry Murphy, Cleveland, Ohio. Vice-presidents—William Crane, Erie, Pa.; H. R. Allensworth, Columbus, Ohio; B. A. Blakey, Montgomery, Ala; F. A. Cambridge, Winnipeg, Man. Secretary, F. P. Foster, Corning, N. Y.; treasurer, C. E. Deihl, Harrisburg, Pa. Executive Committee—T. C. O'Hearn, Cambridge, Mass., chairman (Inspection); A. S. Hatch, Detroit, Mich. (Electric Lighting); J. B. Yeakle, Baltimore, Md. (Fire Alarms); Louis Gascoigne, Detroit, Mich. (Underground Construction); W. M. Petty, Rutherford, N. J. ("Question Box"); James Grant, New Haven, Conn. (Membership); W. H. Thompson, Richmond, Va. (Associate Members); W. Y. Ellet, Elmira, N. Y. (Aerial Construction). Finance Committee—W. D. Clayborne, J. F. Macdonald and H. C. Bundy.

During the sessions of the members the ladies, who were entertained by a ladies' committee, were conveyed in carriages and trolleys to various places of amusement. Each evening members and guests were treated to trolley rides, one of the places visited being Waldameer, a neighboring amusement resort. At the conclusion of the final session a "fish fry" was served at Four Mile Creek. The usual courtesies of free service were extended by the Western Union and Postal Telegraph Companies and the Bell and Mutual Telephone Companies, for both local and long-distance service.

A Thumbnail Sketch of Mr. Westinghouse.

In the September *American Illustrated Magazine* there is a biographical sketch of Mr. George Westinghouse by Robert Mayhew. It is quite interesting. We quote the subjoined passages: "At 59 George Westinghouse stands as the originator, organizer and responsible directing head of industries employing thirty thousand persons, on whom seventy-five thousand more are directly dependent, and indirectly supporting twenty-five thousand persons in addition to these. None but the German manufacturer Krupp comes to mind as equaling Westinghouse in industrial importance. Where Krupp built with destruction in view, the genius of Westinghouse ever has been directed to improving and enlarging the arts of peace. The financier whose manipulations in the field of speculation give a false value to securities of doubtful merit, who, when he has boosted prices to an attractive figure, steps from under after pocketing the profit of the faith of the public, may be of some use as a patron of the arts and gentleman sports, as the supporter of great private estates, as a generous tipster of menial servants, and in other ways in which money may be prodigally kept in circulation, but does he compare in usefulness with the great nurseryman who conceived and fostered and to-day guides and controls the parent plant and the spreading branches of the Westinghouse works?

"George Westinghouse is a great big man physically and mentally. His is a giant's body, but his mind outclasses it. He is shrewd, far-sighted, goes straight to the heart of any problem, grasps every point of a subject quickly, separates the practical from the chimerical immediately, and enters enthusiastically into anything that appeals to him as of merit. Once convinced himself, he has no difficulty in convincing others. He is bland and smooth, reasonable within human bounds, but impatient of opposition. That which he enters into he dominates, not through the mean spirit of pride of power, but from the consciousness of inherent superiority, a self-confidence justified by his own accomplishments in a long career of conspicuous success.

"There is some love of display in Mr. Westinghouse, but it is not personal vanity of a mean order. It is the bubbling of his enthusiasm and pride in the works that bear his name. They are so highly organized, so clean and well kept, that when Mr. Westinghouse entertains a real party he sets the tables in one of the shops and serves a banquet to as many as a thousand guests there. Look into his great, gray eyes; note his kindly smile; feel the warmth of his hearty grip as he shakes your hand—it's no bloodless bloodsucker you're meeting. His talk is all of achievement.

"Stock values hold little interest for him except as they have a bearing on flotations of new issues made necessary by demands for enlarging capacity. The dividends his companies pay tell the story of their success. His relations with financiers are not those of a jobber in securities; his enormous enterprises legitimately demand legitimate financing. And, though he dominates his companies to such an extent that he is the whole thing in fact, the utmost confidence is reposed in him; so much so that, though his electric company has not made a report nor held a stockholders' meeting for eight years, nobody seriously objects to this fact, which in another concern would amount to a scandal and lead to court proceedings."

Subway Development in New York Suburbs.

As a result of the success of electric traction underground, the plans already approved by the Rapid Transit Commission provide for many new subway routes in the Bronx. One of the most important of the Bronx rapid transit lines to be built will be that along 138th Street, Southern Boulevard and Westchester Avenue to the former village of Westchester. This line, which may be extended later to Pelham Bay Park, will have three tracks, and will connect with the First Avenue Subway in Manhattan. Another important subway in the Bronx will be that along Alexander Avenue from the Harlem River, where it will connect with the First Avenue Subway. This will be a four-track line, and will do much to relieve the crush on the Third Avenue elevated, as it parallels the elevated for the whole of its route.

A line which will open up a large section now depending upon surface cars for transportation will be the lately approved extension of the present Subway-Elevated on Westchester Avenue from West Farms to the Mount Vernon city line, the terminal station to be situated at 241st Street and White Plains Road. This extension will cross the Bronx River over a double-decked steel bridge at West Farms Road, and it will also cross the Bronx-Pelham Parkway over an ornamental structure. The viaduct will have two tracks as far as the Bronx River and three tracks beyond to the terminal.

The Third Avenue Subway will enter the Bronx just east of the Third Avenue Bridge. This will also be a four-track line, and will do much for the great business center of the Bronx, in which it will have its terminal loop. It will furnish a direct route to the Battery from the heart of the Bronx. The Jerome Avenue Subway and Elevated, which has long been contemplated, and is now approved, will extend from the Harlem River, at 155th Street, through a tunnel under the high ridge just north of the Harlem, to 168th Street, and thence over a viaduct up Jerome Avenue to the entrance to Woodlawn Cemetery at Woodlawn Road. This will be a three-track road for the greater part of its length, and will tap a territory now without proper transit facilities, but having a considerable population. The Gerard Avenue Subway will extend from 138th Street and Third Avenue to 169th Street and Jerome Avenue, forming a junction with the road to be built along the latter thoroughfare. This line will be entirely underground, except at its junction with the Jerome Avenue line, and will consist of two tracks, which, it is thought, will be sufficient to meet the demands of the territory it will reach. All these systems will demand in the aggregate an immense amount of electrical plant and material for equipment, and of supplies and current for operation.

CURRENT NEWS AND NOTES.

EDISON CONVENTION.—The annual convention of the Association of Edison Illuminating Companies will be held at the Hotel Champlain, Clinton County, N. Y., on September 12, 13 and 14, when a large attendance from member companies is expected. Mr. J. B. McCall, of Philadelphia, is president.

IOWA INDEPENDENT TELEPHONY.—The Iowa Telephone Association has held a meeting and decided to adopt the National-Interstate district plan of organization. District meetings will be announced by the officers of the associations at an early date, and the organizations in the various districts will be perfected in the near future.

TROLLEYS IN CHILI.—The Valparaiso Electric Tramway Company is extending its line to Vina del Mar, a suburban town seven miles distant from this city. An electric car system for Conception, with an interurban line from Conception to Coronel and Talcahuano, is being projected, and will be built within the next year, but the plans are not completed. The system will be constructed upon the American plan and financed by an American company.

ACCIDENT AT DANVILLE, ILL.—Advices from Danville, Ill., of August 28 say: "Two men were fatally hurt and three others were severely burned this afternoon by the bursting of a sixteen-inch steam pipe at the Danville electric light plant. Danville is in darkness to-night and no street cars are running." The Danville Street Railway & Light Company has an extensive system, with sub-stations, etc.

PRESIDENT AND PLUNGER.—Although it was stated officially that he would not do so, President Roosevelt shortly after 3 o'clock p.m., on August 25, went aboard the Holland type submarine boat commanded by Lieut. Charles Preston Nelson and remained under water off Oyster Bay for fifty-five minutes. He made a close study of the electrical mechanism and handled it for himself during the manœuvers.

PUBLIC LECTURES IN NEW YORK CITY.—The Department of Education of the City of New York has issued a report on the course of public lectures held during the winter of 1904-1905. The total number of lectures delivered during the season was 4,645, and, although this number was twenty lectures less than had been given in the previous season, the attendance showed an increase of about 30,000, reaching a total of 1,153,991. Forty-nine of the lectures dealt with the general subject of physics, while sixty-five treated specifically of electricity and magnetism.

TELEPHONIC LITIGATION.—Hon. O. S. Berry of Carthage, Ill., has been appointed and approved as the fifth member of the committee on Litigation and Legislation of the National Interstate Telephone Association, a vacancy being left by the officers when making up this committee in order to give Illinois representation when the state had been organized. The other members of the committee are: Dwight E. Sapp, Mt. Vernon, Ohio; Edward E. Clement, Washington, D. C.; Breckenridge Jones, St. Louis, Mo.; J. B. Ware, Grand Rapids, Mich.

TELEGRAPHERS' SOCIAL CONVENTION.—The Old-Time Telegraphers' Association and the United States Military Telegraph Corps are holding their annual conventions this week in New York City, with headquarters at the Waldorf-Astoria. It is ten years since they were here last. At the meeting on Tuesday of the Old-Timers, Mr. W. H. Young, of Washington, D. C., was elected president to succeed Mr. John C. Barclay. Mr. W. L. Ives was elected vice-president and Mr. John Brant secretary. The festivities of the week include a big banquet at the Waldorf on Thursday night.

NEW WIRELESS SYSTEM.—A special dispatch from San Francisco of August 23 says: "A new wireless instrument weighing but a pound and a half, and under exhaustive tests giving better results than the more cumbersome machines now in use, has been invented at the Benicia Barracks by Hugh Annis, a young soldier of the Signal Corps. The machine has transmitted and received messages between Mare Island and the Yerba Buena station time after time. The apparatus is being used at the barracks. Placed on the ground, the machine will signal the footsteps of a man walking a hundred or more feet away. The materials used in construction are simple. Annis is a graduate in electrical engineering of Purdue University.

PACIFIC-CANADA CABLE.—The Postmaster-General of Canada, Sir William Mulock, who left Canada shortly before the close of the last session of Dominion Parliament, has returned to Ottawa. He attended the Pacific cable conference held in London from July 20 to 28. The conference, consisting of representatives from all the governments interested in the cable project, prepared a report which states that the financial loss, on the operation of the cable, was largely due to the action of New South Wales in having granted special concessions to a rival company, the Eastern Telegraph Company, and also to similar action on the part of the State of Victoria. The Australian commonwealth, however, with the avowed object of terminating these concessions, entered into another agreement with the Telegraph Company designed to bring the concessions to an end at a fixed date. It appeared that the arrangement has failed to accomplish the purpose aimed at. The Pacific cable conference, having obtained legal advice to that effect, had, in its report, called upon the Australian government to amend the agreement, so that the objectionable concessions might absolutely terminate in 1913. Should the Telegraph Company refuse to consent to the change, however, the agreement, as respects New South Wales, will continue in perpetuity, and therefore seriously prejudice the interests of the all-British Pacific Cable.

A VISIT TO NIAGARA has been made by Prince Louis of Battenberg, who is in command of the British squadron about to cruise in American waters. Last week he visited the Falls, travelled by trolley up and down the Gorge, and inspected the power plants.

LONDON POWER ACT.—The proposed act for unifying current generation in London—the "Power Bill"—has gone over for the present session and will, it appears, have to be taken up *de novo* at the next session of Parliament. There would seem to be every likelihood of its final passage, and steps are being taken with that in view by various local authorities needing current.

THIRD-RAIL PRECAUTIONS.—The Rockaway division of the Long Island Railroad has hitherto been freely open to foot travel, but now the third rail is going down, it is being shut in by heavy wire fence out to Far Rockaway. Elsewhere, precautions are being taken to protect the road from the foolery and incaution of such members of the community as take delight in trying the effect of interposing their bodies as a short circuit.

TELEPHONY IN MISSOURI.—Twenty telephone exchange owners and managers, composing the Independent Telephone Association of the Second and Third Congressional Districts, met August 23 at Chillicothe, Mo., for the purpose of discussing toll rates and the improvement of service between the large towns in the district. A. Barnes, of Hamilton, is president of the association and presided at the meeting.

A SINGLE-PHASE ROAD FOR INDIANA.—Mr. W. H. Schott, of Chicago, president of the Terre Haute & Indiana Southern Railway, states that the construction of the company's proposed single-phase line will be begun in the near future, possibly this month. It is to be 70 miles long and will connect Terre Haute and Linton with belt lines to the coal district. The road will be standard gauge and operate twelve cars. The power station and the repair shops will be located at Shelbourne. Mr. Schott himself will act as chief engineer of the company.

INTERURBAN TRAFFIC MEN ORGANIZE.—For the betterment of the service generally and to encourage interchange of traffic among the various local interurban electric railways, the Toledo Interurban Traffic Association, composed of the general freight and traffic managers of the different roads, has been organized, with C. T. Chapman, of the Toledo & Western, with headquarters at Sylvania, as chairman; Robert Dittenhaver, of the Toledo & Indiana, with headquarters at Delta, treasurer, and J. S. Young, of the Maumee Valley & Toledo Railways & Light Company, as secretary. The organization will be made permanent.

THE DETROIT ELECTRIC TUNNEL.—Work on the railroad tunnel which is to be constructed under the Detroit River between Windsor and Detroit was begun last week, when a force of men was set to work sinking the shaft on the American side. A similar shaft will soon be sunk on the Canadian side. While there is still much preliminary surveying and testing to be done, the location of the tunnel is practically decided upon. The actual length of the underground portion of the tunnel will be two and six-tenths miles, and the distance from surface to surface about three miles. It is estimated that between two and three years will be occupied in the construction.

TROLLEY SHORT STORIES.—The Detroit United Railway announces the opening of a short story contest to the children regularly enrolled in the schools of Wayne, Oakland, Macomb, St. Clair and Genesee Counties, through which the lines of the company pass. The contest will be open a sufficient length of time, about nine weeks, to give every boy and girl a chance to become settled in the year's school work and give proper time to the composition. There are to be three prizes, the first of $25, the second $15, and the third $10. The theme of the story is to be confined to some incident, experience or anecdote descriptive of travel on the electric cars. No story must be more than 2,500 words or less than 1,500 words in length. The compostion must be absolutely original. A committee, consisting of three of Detroit's best writers, authors or newspaper men, will pass upon the manuscripts submitted. It is planned to publish the first prize winner and possibly all three winners in the daily newspapers.

CHICAGO MUNICIPAL TROLLEYS.—About 1,100 cars, costing nearly $6,000 apiece and involving a total expenditure of approximately $6,500,000, are said to comprise the equipment of the proposed Chicago Municipal Street Railway, as suggested by the report of expert Dupont, of Detroit. The report has been completed by its author and is now in the hands of Special Traction Counsel Clarence S. Darrow for submission to the Transportation Committee of the City Council, which will handle the problem. Mr. Dupont has submitted a plan for a traction system of 264 miles, which can be ready in 1908 at a cost of $25,000,000. He asserts that the net income will exceed $2,800,000 per year.

NEW SUBMARINE BOAT.—John P. Holland, the submarine inventor, has announced that he has perfected a boat that he is confident can be operated under water at a speed of twenty-five knots an hour. Mr. Holland completed plans for the boat two months ago and they were sent to Washington. They call for a boat eighty-five feet long, eight feet six inches wide and seven feet draught. The vessel will weigh 95½ tons. "I am confident I have solved the high-speed problem for the submarine boat," said Mr. Holland. "I shall have a boat of full size constructed with money supplied by private parties. It will require in the neighborhood of $125,000 at the start. The report of the government test shows that a full size boat, built according to my plan, should make thirty knots, but I will be satisfied if it makes from twenty to twenty-five."

TROLLEY UNION DEPOT AT TOLEDO.—L. E. Beilstein, general manager of the Toledo Railways & Light Company, is making plans for a union passenger station for the interurban roads entering the city. The company owns almost the entire square bounded by Beach, Huron, Superior and Jackson Streets, in the downtown section of the city. The union freight station is now located on this site, and it is intended to erect a building there of several stories and about 500 feet long, where the roads could have their offices. A proposed feature is to have the passengers take the various cars by way of a basement, descending stairs from the waiting room with passages leading to any desired track. In this way there would be no crossing of tracks. The entire rear of the building would be devoted to tracks and it would have a shed covering of glass and structural work.

A RULE FOR SUCCESS.—When Mr. L. F. Loree was president of the Baltimore & Ohio, one of the subsidiary lines of the Pennsylvania, a young man in search of a position was sent to him from the Reading Railroad, writes C. M. Keys in *The World's Work* for September. The youth was recommended by a vice-president of the Reading. Mr. Loree asked him a multitude of questions about what he could do. The applicant, who was seeking a clerical position at the head office, had been an assistant comptroller for a small electric line, had worked in the freight department of the Lehigh Valley and had helped the comptroller of the Reading to keep accounts. He knew the routine of practically every department. At the end of the interview Mr. Loree said: "Young man, you know too much and too little. The rule on the Baltimore & Ohio is, 'Know a little, but know it perfectly.' We want specialists on these lines. We do not want our transportation men figuring on the methods of gathering traffic, nor do we want our traffic men figuring on the operating details. Specialize and you will succeed on the Baltimore & Ohio."

DELICIOUS INCONSISTENCY.—The New York *Herald* is glorying in the fact that the automobile service of the Paris edition beats the telegraph service of the French government in speed, and at the same time has applauded the transfer of the private telephone system in England to the hands of the Post-Office. Let us quote: "As our readers are aware, huge bundles of *Heralds* for Trouville leave Paris every morning at 4 o'clock, and, under most unfavorable circumstances, reach their destination three hours later. The magnitude of this feat is manifest only when the performance is contrasted with the results achieved in the telegraph department. The *Herald* is indebted to the government for its characteristic, though by no means unique, opportunity to make such a comparison. The *Herald's* sporting correspondent in Trouville telegraphed his account of the Grand Prix de Deauville early Sunday evening and the despatch arrived at its destination at the *Herald* office on Monday morning, some fourteen hours later. The *Herald* is completely satisfied with its victory."

POWER FOR ORANGE GROWERS.—The farmers and orange growers in the vicinity of Pomona, Cal., are organizing a company to build an electric power plant with which to furnish power for all pumping plants in the vicinity and operate a belt trolley line, connecting all the near-by towns and ranches, including Chino, Ontario, Claremont, North Pomona, Lordsburg, San Dimas and Covina.

MAGNETIC SURVEY YACHT.—The Carnegie Institute of Washington, D. C., has asked the Department of Commerce and Labor to reclassify the yacht Galilee, so that it will not be compelled to enter and clear at customs ports, while engaged in making a magnetic survey of the North Pacific Ocean. The yacht has been chartered at San Francisco by the department of terrestrial magnetism of the institution. Four scientists have been engaged to make the survey, for which $25,000 has been appropriated, and the work will probably cover a period of three years. The yacht is now registered as a merchantman, which would require that it clear at all domestic and foreign ports entered. To escape this provision, the yacht would have to be registered as a pleasure craft. Under either classification the Department of Commerce and Labor would have to stretch a point, technically, and an effort will be made to give the Carnegie Institution the relief sought.

LECTURES AT THE NEW YORK TRADE SCHOOL.—Following the usual custom a series of evening lectures on steam and electrical engineering will be given during the coming fall and winter at the New York Trade School, First Avenue, Sixty-seventh and Sixty-eighth Streets. These lectures are intended for practical workers—stationary engineers, firemen, electrical workers and machinists. They present an attempt to fulfill a long-felt want for practical information and explanation of phenomena and experience of daily occurrence. The lectures take more of the nature of a conversation between the lecturer and his hearers, and questions are freely asked and explanations given accompanied by illustrations, and, where possible, by experiments. The main object of this course is to present in a simple and easy way to men of practical experience the reasons for the laws upon which their trade is based, and explanations of the phenomena that have led to the formulation of these laws. It is believed that in this way only can a man learn to do effective work, as a workman knowing only the rule of thumb is indeed laboring under a disadvantage, and unless trained to study he can hardly hope to obtain the necessary information from textbooks. The cost of attending each of the courses on steam and electricity is one dollar. Information as to dates and arrangements can be had on application to H. V. Brill, superintendent, New York Trade School, Sixty-seventh Street and First Avenue, New York City.

POPULAR SCIENCE.—Our sprightly contemporary, *The Electrical Times* (London), in a recent issue has some fun apropos of an article on lightning, written for popular consumption. The journal in which the article appears had, it says, "*Ideas* on the outside. On the inside, however, there were other things, particularly an article on 'When the Thunder Rolls.' It is written in journalese by a man—or lady—who is as ignorant about thunder as about English composition. I learn that 'to the generality of people storms of this nature burst upon them unanticipated, and if encountered in the streets of a town or the open country the only misfortune apprehended is a wetting . . . Lightning is only electricity highly concentrated . . . There are agents which attract it, and others which repel or cut off its contact . . . Among repellants are glass, silk, wool and feathers, when dry.' As a 'perusal of the glass and thermometer will always give the scientific student a timely foreknowledge of coming events,' no doubt the writer of the article, when he anticipates the encountering of a thunderstorm, will dress himself in such agents as dry feathers. I suggest he add tar, as being also a good repellant agent. If the writer is a lady, I withdraw the suggestion, and leave her costume to her own scientific judgment." Directions in absurd detail are given as to further protection from lightning and, continues our contemporary, "there is a cut of a sort of *Family Herald* young man and his wife sitting on chairs on a mattress in the center of a room, with the fire-irons under the hearthrug."

Electrical Engineers of the Times.—XXV.

HENRY FLOY.

Henry Floy was born in Elizabeth, N. J., September 19, 1866. He is a son of James Floy, and a grandson of the Rev. Dr. James Floy, a noted Abolitionist. He graduated from Wesleyan University in 1889, after which he entered Cornell University, and in the space of two years completed the regular four-year course in electrical engineering. While at these universities he took an active interest in athletics, and was a member of the football teams of both institutions. In 1892 Wesleyan University conferred upon him the degree of Master of Arts.

Shortly after leaving Cornell Mr. Floy entered the engineering department of the Westinghouse Electric & Manufacturing Company, at Pittsburg, where he remained until 1896. For the same interests he spent the following two years in Chicago as engineer of that office, after which he took charge of the company's office in Minneapolis, representing it in all States throughout the Northwest as far as Montana. While in this position he had unusual opportunities to study long-distance electrical transmission and water power developments.

Having had seven years of varied experience in engineering work, Mr. Floy felt that he was now equipped to establish himself as a general consulting engineer, and in 1899, in conjunction with Prof. R. C. Carpenter, of Cornell University, he opened an office in the St. Paul Building, New York City, where he has been located ever since. The firm of Floy & Carpenter continued for three years. During this time many important engineering projects were under-

HENRY FLOY.

taken by them. Subsequently Prof. Carpenter was compelled to relinquish his duties because of ill health and pressure of college work.

By the installation of a 25,000-volt underground transmission system in St. Paul, Minn., Mr. Floy gained a wide reputation. This was among the first, if not the very first, really high-tension underground transmission in the world. A complete account of this work was given by Mr. Floy in a paper which he presented before the American Institute of Electrical Engineers, November 23, 1900.

Among the projects engineered by Mr. Floy are the plants of the St. Louis Smelting & Refining Company in Missouri and Illinois; several installations for Mr. Flagler's hotels in the South, notably the Ormond Hotel, Ormond, Fla., and at Nassau, Bahama Islands; the Consolidated Electric Company, near Albany, N. Y.; the St. Croix Power Company, Wisconsin, and others. He has also been retained for important engineering work by the Newport News Ship Building & Dry Dock Company and the Standard Oil Company. Of recent years Mr. Floy has devoted considerable attention to modernizing shops and factories. The excellent results of his work in this direction in a number of large factories are well known, particularly in the several works of the National Lead Company. He is at present retained by the latter concern as consulting engineer for all of its plants throughout the United States.

Mr. Floy was a member of the Electrical Jury of the International Committee of Awards, at the World's Fair, St. Louis, 1904. He has also been a frequent contributor to technical journals, and is a member of the American Institute of Electrical Engineers, the Engineers' Club, the Phi Beta Kappa Society, the Cornell University Club, of New York, the Wesleyan University Alumni Association, and the Psi Upsilon Club.

Waterside Station No. 2 of the New York Edison Company.—I

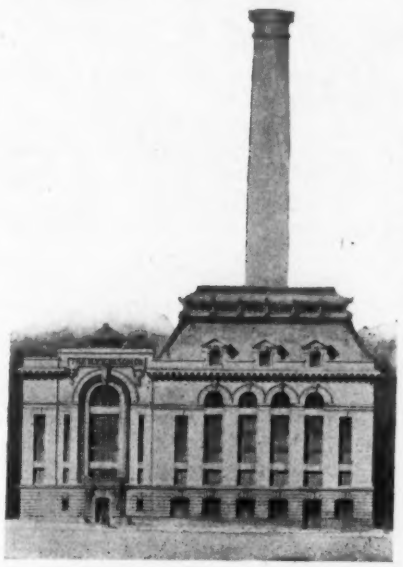


FIG. 1.—END VIEW OF STATION.

AN excellent illustration of the progress in electrical service for lighting and power is presented in the growth of the business of the New York Edison Company of New York City, which recently has necessitated the installation of a second mammoth generating plant to supplement its famous "Waterside" station. At the time of completion, late in 1901, of the original Waterside station, with the initial generating capacity of over 32,000 kw, it was thought that it would be able to provide, particularly when completed to its contemplated total capacity of over 64,000 kw, an ample supply of power for many years to come. But scarcely three years later it became evident that the original Waterside, although completed to nearly its maximum capacity, would within another year be entirely inadequate for the increasing demand. The outcome has been the design of the second large generating plant, known as "Waterside Station No. 2," to which this article is devoted.

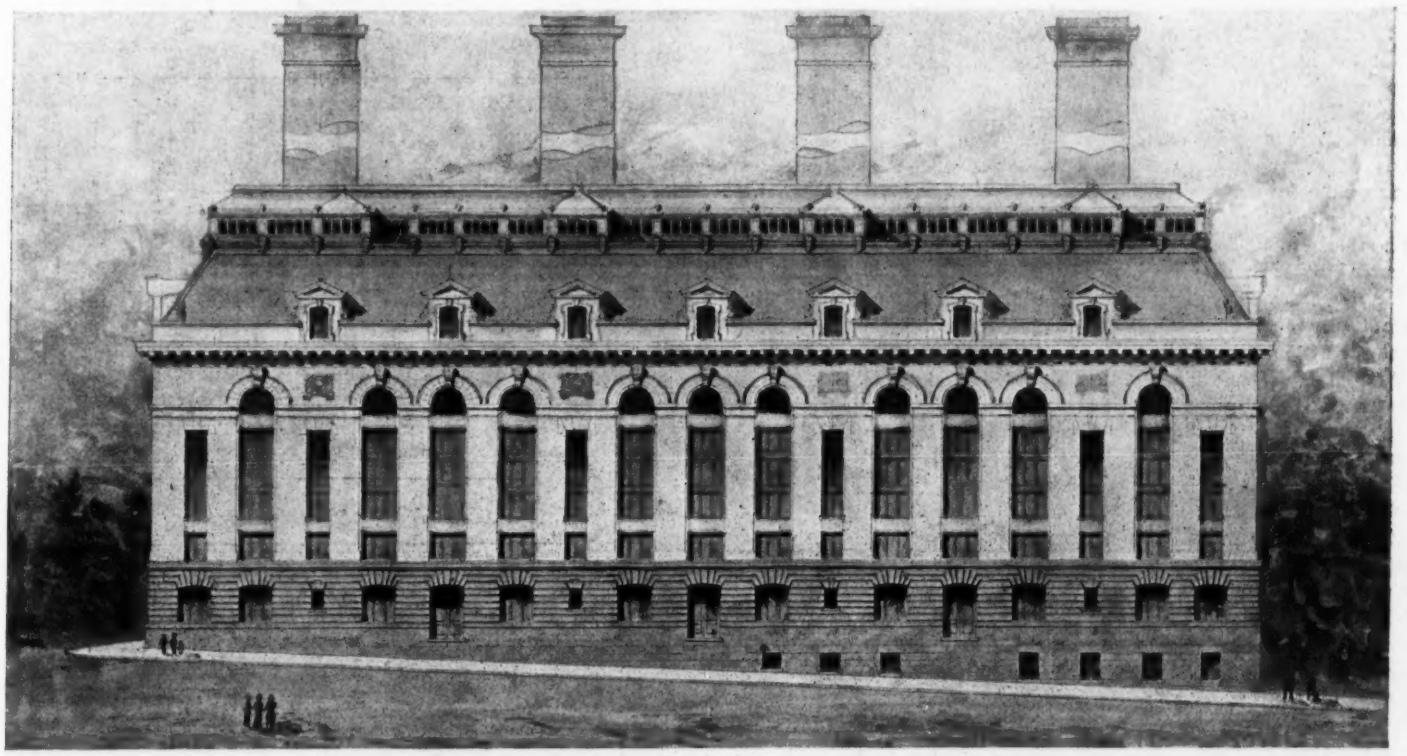


FIG. 2.—WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY.

The new plant, while following in general the lines of design of the older station, is remarkable further as an example of the evolution in power plant practice resulting from the perfection within a few years past of the steam turbine as a prime-mover. The New York Edison Company was the very first in this country to use steam turbines in its generating equipment, having installed and operated in its stations two 300-hp De Laval steam turbines as early as 1896. When the first Waterside station was being designed, the steam turbine had scarcely been considered in units of large capacity, but in this country at least, in connection with electrical generation, its development has been so rapid and successful that before all the generating equipment had been placed in the original station the advantages which it offered had become sufficiently apparent to warrant the installation of turbines instead of the last few engine-driven generating units as orginally intended, and instead of five engine units there were installed four 5,000-kw Curtis turbine generating units.

The new station involves, in addition to the use of turbines, other interesting departures from usual practice, in both design of buildings, and selection and arrangement of apparatus.

The history of the New York Edison Company begins with the historic Pearl Street station, superseded later by the more modern Duane Street plant, one of the very first where vertical marine engines were adapted for direct connection to multipolar, slow-speed dynamos. The system of the company grew until finally six generating stations of considerable size were in operation, in different sections of lower New York. In 1896 an annex station was located corner 72d St. and 5th Ave., one with an equipment of a 240-kw two-phase motor, driving two 100-kw, direct-current generators, the motor receiving two-phase high-tension current from the East 80th St. station; this was the beginning of high-tension transmission in connection with the company's development. Later, owing to the differences in time of the peak loads upon the various stations and the consequent desirability of interconnecting them in order to help each other out, several stations were equipped with converters, transformers, etc., for high-voltage transmission between stations; from this development the sub-station method of distribution, now in universal use for distribution over extended areas, followed logically. Sub-stations were then installed rapidly and, owing to the wide extensions of the low-tension street service thus made possible, the business of the company correspondingly increased. In fact, the Waterside generating plant has operated with an overload ever since its completion, and it has been almost impossible for the company to install new generating equipment rapidly enough to provide for the growth of the load. The result has been the design of a second Waterside station which will have an ultimate capacity of over 30 per cent greater than that of the original plant. Even with this and many other improvements now under way, the policy of the company points very strongly to the fact that it realizes that the growth of the service is as yet only in an early stage, and that the possibility of development through rendering a reliable, low-price and satisfactory service is almost beyond estimation.

The actual growth of the company's distribution service will be evident from the large amount of additional sub-station equipment which it has been found necessary to install within the past two years, this amounting to over 45,000 kw in capacity of converters and the necessary auxiliary equipment. In this time, there have been installed three new sub-stations, located as follows: Clinton St., near Grand St. (2,000 kw), for supplying the lower East Side; West

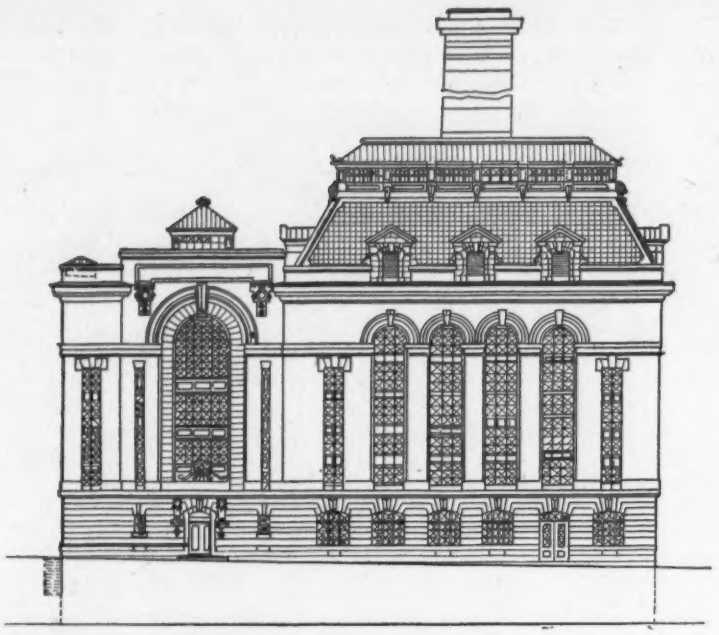


FIG. 3.—FRONT ELEVATION.

27th St., near 10th Ave. (2,000-kw), for assisting the 26th St. station in supplying the theatre and shopping district; and West 107th St., near Broadway (2,000 kw), for assisting in the residential district. There are now in all 19 independent sub-stations connected to and operated from the Waterside plant, embracing a total converter equipment of nearly 80,000 kw capacity, for the local street distribution service, not including a number of private sub-station equipments for the operation of certain industries. All but one of the sub-stations are provided with storage battery equipments which float on the direct-current distribution system, partly to assist the main generating station in carrying over the peak load, but principally to insure the service against even the slightest interruptions of current supply. Moreover, four of the former generating plants, now operated as sub-stations, still retain their steam generating equipments in reserve for further insurance against interruptions of service due to accident to any part of the high-tension transmission system; these stations, which are the Gold Street, the Duane Street, the Twelfth Street and the Twenty-sixth Street plants, are, however, operated regularly only during the period of heavy loads in the winter season.

One of the important questions connected with the design of the new Waterside station was the location. While the original Waterside had been located considerably to the north of the actual center of consumption of current from sub-stations at the time of its installation, still the trend of the growth of the service has shown with increasing force the wisdom of this selection. The tendency of the growth and development in the City of New York has been constantly toward the uptown districts during the past few years, and in all probability the locations of future sub-stations will lie to the north of Thirty-ninth Street. Accordingly there was nothing to be gained in the selection of a site far removed from the present Waterside station, while a location adjacent or alongside would realize the many advantages from interconnection both on the electrical and steam ends for the most favorable utilization of apparatus. While Waterside No. 1 and Waterside No. 2 will be provided with tie connections, both in the electrical and steam equipment, independent feeders from each will supply the several annex stations over different subway routes, thus providing the advantage of two independent sources of current supply with the economies of joint operation. These, and the consideration of advantage of unified supervision in one location, led to the selection of a site immediately adjoining the original Waterside, where the two stations, although limited from actual interconnection of buildings by an intervening street, are nevertheless near enough together to permit of a most advantageous arrangement of interconnection of the steam and of the electrical systems.

For the new station the entire city block immediately to the north of that occupied by the original plant was secured, thus providing for the new plant facilities for receiving its coal supply by water shipment and a permanent supply of condensing water, equal to those enjoyed by the other. The block occupied is bounded on the west by First Ave., on the sides by 39th and 40th Sts., and to the east by the East River. The new plant will occupy the entire length of the block, 338 ft., whereas the original station occupies only 272 ft. 6 in. of its plot. The space of 125 ft. adjacent to the river's edge will not be built upon, as it may eventually be reclaimed by the city for use as a river front street; but upon it will be located the coal and ash handling tower and equipment. This location provided excellent foundation facilities for the accommodation of heavy machinery, solid rock of the mica schist variety having been found to underlie the entire area. The loose earth above was removed entirely and the rock leveled off or excavated to receive the grillages for the column footings. At the river end of the block the rock lay much farther beneath the surface, so that while at the First Ave. end the rock had to be excavated to receive the column footings, toward the river, piers from 10 ft. to 30 ft. high were necessary to reach to their level. For the circulation water inlet and discharge tunnels, a trench approximately 35 ft. wide by 30 ft. deep had to be excavated.

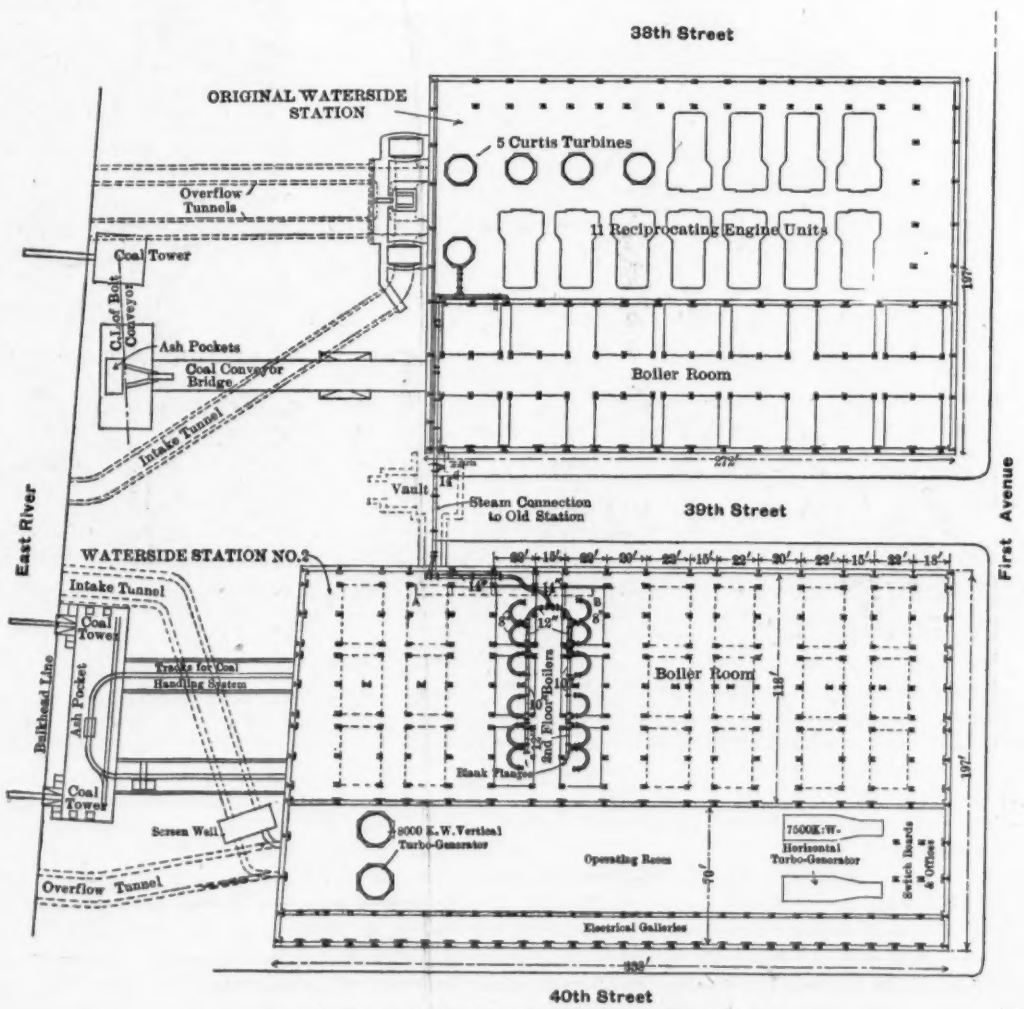


FIG. 4.—PLAN OF THE TWO POWER HOUSES.

The boiler room section consists of a 20 ft. basement, one 36-ft. and one 34-ft. story for the boilers and above this a space of 50 ft. up to the general roof level, which is devoted to the coal storage bunkers; the coal-handling system will be accommodated in the roof monitors. The turbine section involves a 25 ft. basement for con-

denser apparatus and a main turbine room with a clear height under roof trusses of 88 ft. The group of side galleries at the 40th St. side of this room consists of six mezzanine galleries above the main floor for the electrical switching equipment, and a basement gallery for a sub-station and reserve exciter storage-battery equipment. As in the original Waterside station, a system of galleries

FIG. 5.—STEEL WORK OF BUILDING.

will be provided at the First Avenue end of the turbine room for the accommodation of the main station switchboard and control board apparatus from which the entire electrical equipment of the station will be supervised and controlled.

The architectural treatment of the exterior while similar to that of the original station is somewhat more ornamental and pleasing. A base of granite extends nearly to the height of the second story, above which rise brick walls of a soft brown color surmounted by a terra cotta cornice. All the wall and dormer window trimmings are of terra cotta, while the roof monitors are of copper finish. The roof of the boiler house is covered with Spanish roll tile on the mansard portion, while all flat sections of the turbine and boiler room roofs are of slag concrete construction covered by flat tiles. A feature of the exterior is the window treatment, all windows being surmounted by a terra cotta architrave which rises from an entablature of terra cotta surrounding the structure. The window in the First Ave. end of the turbine room received special treatment with a very pleasing effect, and is surmounted by the name of the company, also in terra cotta.

The power house building is of steel frame and brick and concrete construction, forming an absolutely fireproof structure throughout. The sectional view of Fig. 7, page 386, shows the principal details of the steel work and coal bunker structure. The boiler-room and turbine-room floors are of very heavy construction, designed for uniform loadings up to 600 lbs. per sq. ft.; the floors are all of concrete upon the Roebling system. In addition the structure carries, on the boiler room side, five large anthracite coal bins to hold a total of 20,000 tons, when all are filled. The coal bins are of reinforced concrete construction with vertical stiffeners of I-beams embedded at intervals. The roof structure above the turbine room is carried by trusses of 57½ ft. span, surmounted by a 20-ft. monitor for lighting and ventilation. The boiler-room roof, monitors and coal-handling apparatus are carried by a series of 72-in. plate girders and 15-ft. Pratt trusses, all of 90-ft. span. The turbine room is traversed by a 50-ton Shaw traveling crane of 52½-ft. span between runway rails.

The station has been laid out to accommodate ultimately ten steam turbine generating units of 7,500 or 8,000-kw capacity each, giving thus a total station capacity of over 100,000 hp, or, with 50 per cent overload rating, of over 150,000 hp. At first, however, only four turbines will be installed, two of these to be of the Westinghouse-Parsons type and the other two of the General Electric Curtis type.

The new 7,500-kw Westinghouse turbine units will differ little from their well known 5,000-kw machines, the same general type and form of unit being preserved in the new design. As to the bulk of the new Westinghouse unit, it will be 50 ft. long, 17 ft. wide and 15 ft. high, occupying thus a total floor space of 850 sq. ft., or 0.113 sq. ft. per kilowatt capacity. It will thus be only about four feet longer than the 5,000-kw turbine unit, while the width will remain practically the same. These turbines will operate at 175 lbs. pressure and 100 degrees of superheat, and the speed will be normally 750 r.p.m. Under the above conditions and a vacuum of 28 in., the steam consumption at full load will be approximately 16 lb. per kw-hour. An important feature of the new design is that its best economy will be secured around full load, although heavy overloads may be carried at any and all times without material sacrifice of efficiency. The design also permits of the turbine developing its full-rated load while being operated without the assistance of the condensers to reduce the back pressure.

The turbo-generators connected to the Parsons type turbines will embody a new enclosed construction which will be effective in entirely eliminating the hum peculiar to high speed turbine generators. They are of the 4-pole type and are wound so as to deliver either 6,600 or 11,000 volts. As connected they will deliver three-phase current at a voltage of 6,600 and frequency of 25 cycles per second. The stationary armatures will consist of a cast-iron frame with laminated core and coils set in partially closed slots; the field cores will be built up of steel castings, with slots milled in the poles to receive the windings, the coils being formed by straps wound flat in the slots and the slots closed by brass wedges. Their efficiency will approximate 97.5 per cent at full rated load, and they will be able to sustain 50 per cent overloads for three hours without dangerous rise of temperature of windings.

The two Curtis turbo-generators to be supplied by the General Electric Company will have normal ratings of 8,000 kw with 50

FIG. 6.—EXCAVATION FOR CONDENSING TUNNEL.

per cent overload capacity for 2 hours. Except for the increase in size, these turbines will closely resemble the 5,000-kw Curtis turbines now in operation in the original Waterside station. Their diameter at the base will be slightly over 15 ft., while the height over governor dome will be 32 ft. Their total weight will be approximately 700,000 lbs. each. In accordance with the latest practice of this company, the water type of step-bearing will be used for supporting the weight of the vertical shaft. The turbines are designed to operate under a steam pressure of 175 lbs., with 100 degrees of superheat.

The generators of the Curtis units have a rating which will permit them to carry a load of 9,000-kw for 24 hours, or an overload of 50 per cent (12,000-kw or 16,000-hp) for two hours. The generators are of the four-pole type, and operating at the normal speed of 750 r.p.m., will deliver three-phase current of a potential of 6,600 volts and frequency of 25 cycles per second. One of the notable features of this new design is the increase of speed, the older 5,000-kw units having been designed to operate at a speed of about 500 r.p.m.

The boiler and coal-handling plant, the exciter, electrical control and storage-battery equipment will be considered in a concluding article.

Prof. Darwin on the Atom.

In his recent presidential address before the British Association in South Africa, Prof. G. H. Darwin said, in effect: "Within the last few years the electrical researches of Lenard, Röntgen, Becquerel, the Curies, of my colleagues Larmor and Thomson, and of a host of others, have shown that the atom is not indivisible, and a flood of light has been thrown thereby on the ultimate constitution of matter.

"It has been shown, then, that the atom, previously supposed to be indivisible, really consists of a large number of component parts. By various convergent lines of experiment it has been proved that the simplest of all atoms—namely, that of hydrogen—consists of about 800 separate parts, while the number of parts in the atom of the denser metals must be counted by tens of thousands. These separate parts of the atom have been called corpuscles or electrons, and may be described as particles of negative electricity. It is paradoxical, yet true, that the physicist knows more about these ultra-atomic corpuscles and can more easily count them than is the case with the atoms of which they form the parts. The corpuscles, being negatively electrified, repel one another just as the hairs on a person's head mutually repel one another when combed with a vulcanite comb. The mechanism is as yet obscure whereby the mutual repulsion of the negative corpuscles is restrained from breaking up the atom, but a positive electrical charge or something equivalent thereto, must exist in the atom, so as to prevent disruption. The existence in the atom of this community of negative corpuscles is certain, and we know further that they are moving with speeds which may in some cases be comparable to the velocity of light—namely, 200,000 miles a second. But the mechanism whereby they are held together in a group is hypothetical. It is only just a year ago that Thomson suggested, as representing the atom, a mechanical or electrical model whose properties could be accurately examined by mathematical methods.

"Thomson's atom consists of a globe charged with positive electricity, inside which there are some thousand or thousands of corpuscles of negative electricity, revolving in regular orbits with great velocities. Since two electrical charges repel one another if they are of the same kind, and attract one another if they are of opposite kinds, the corpuscles mutually repel one another, but all are attracted by the globe containing them. The forces called into play by these electrical interactions are clearly very complicated, and you will not be surprised to learn that Thomson found himself compelled to limit his detailed examination of the model atom to one containing about 70 corpuscles. It is indeed a triumph of mathematical power to have determined the mechanical conditions of such a miniature planetary system as I have described. It appears that there are definite arrangements of the orbits in which the corpuscles must revolve, if they are to be persistent or stable in their motions. For the purpose of general discussion, which is all that I shall attempt, you may take it that the number of corpuscles in such a community is fixed; and we may state that definite numbers of corpuscles are capable of association in stable communities of definite types. An infinite number of communities are possible, possessing greater or lesser degrees of stability. Thus the corpuscles in one such community might make thousands of revolutions in their orbits before instability declared itself; such an atom might perhaps last for a long time as estimated in millionths of seconds, but it must finally break up, and the corpuscles must disperse or rearrange themselves after the ejection of some of their number. We are thus led to conjecture that the several chemical elements represent those different kinds of communities of corpuscles which have proved by their stability to be successful in the struggle for life."

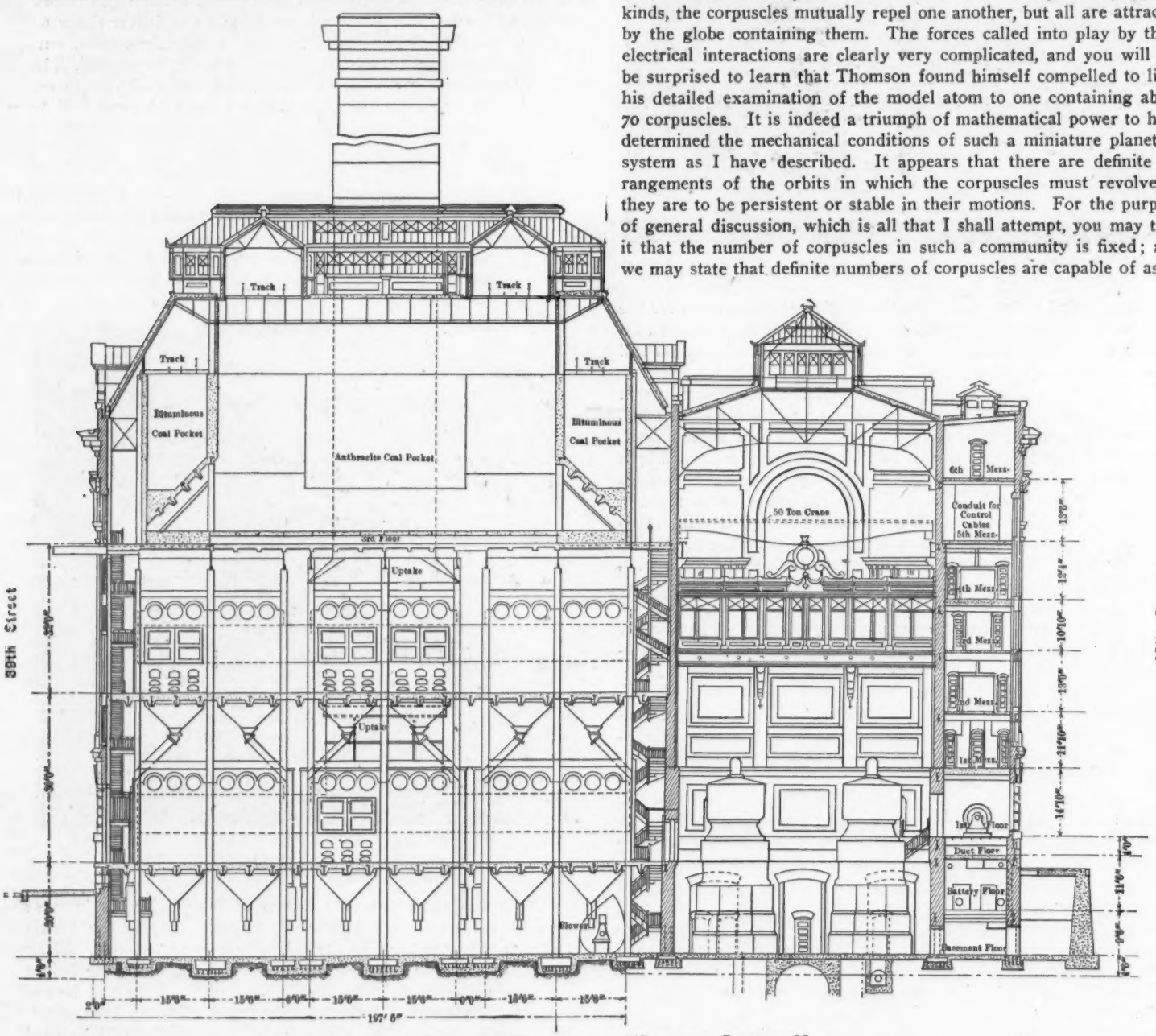


Fig. 7.—Sectional Elevation of Waterside Station No. 2.

Hydro-Electric Developments of the Ontario Power Company.—II.

THE PIPE LINE.

THE intake works and forebay, which were described in the preceding section of this article, were designed to intersect water for a generating station having a capacity of not less than 180,000 hp, but it has since been decided, owing to the ample supply of water, to develop 200,000 hp with an installation of 22 units of 10,000 hp each, thus allowing two spare units. It was decided to use three pipe lines to convey the required quantity of water for this development from the gate house to the cliff above the generating station. The first of these pipes, a view of which is given in Fig. 8, is now in position. It has an internal diameter of 18 ft. and is 6,160 ft. long from the head gate to the center of the first penstock with which it connects. The other two conduits will be approximately 20 ft. in diameter, and will probably be built of reinforced concrete. In this first pipe will flow the water for the wheels connected to 60,000 hp of main generators and their exciters, also a reserve unit of 10,000 hp.

The three conduits to be employed in this installation are of especial interest as they are the largest ever used for a like purpose. After leaving the gate house the course of the pipe lines passes under the stream that flows into the river after its circuit of Dufferin Islands, and then through Queen Victoria Park to a

FIG. 8.—NO. 1 CONDUIT, SHOWING BULB TEES.

point opposite Goat Island, terminating in a distributor and a spillway. Here penstock shafts and tunnels run through the cliff to the power station in the gorge below. In the headblock the 18-ft. pipe has a center elevation of 534 ft., and where this pipe joins its first penstock in the cliff its center elevation is 506 ft. The fall of this pipe in its course is thus 28 ft., and its center elevation at the first penstock is 47 ft. below the minimum elevation of water in the forebay. In its course through the park the pipe is made up of long tangent sections connected by a few easy curves, and the profile of the line is such that the pipe is almost wholly beneath the natural surface of the ground throughout its entire length. At points where some portion of the pipe line rises above the natural surface of the park earth is terraced over it, and through the whole distance the natural appearances are carefully preserved.

Structurally the pipe is made up of steel plates ½ in. in thickness, 8.5 ft. wide and 19 ft. long, which are connected at lap joints by double rows of ⅞-in. rivets. At intervals of 4 ft. along the outside of the pipe it is strengthened by 7-in. bulb tees of steel that were bent to its circumference and secured to the plates by rivets. (See Fig. 8). These bulb tees extend over the top half of the pipe and to a distance of 2 ft. below the center line on each side. Both the steel plates and the bulb tees for the pipe were bent to the required radius and punched for the rivets in a machine plant built for the purpose near the line. Before riveting the steel plates of the pipe together, they were drawn into position by temporary bolts that were passed through the rivet holes and subsequently removed. The pipe trench was excavated largely through rock, and when the pipe was first laid it rested on saddles of 12-in. square timbers spaced a few feet apart across the bottom of this trench. After the steel pipe was completed it was encased in gravel concrete having a thickness of 12 in. on top, 3 ft. on the sides and 12 in. on the bottom; that is,

FIG. 9.—VIEW SHOWING CONCRETE COVERING AROUND CONDUIT, AND WIRE FOR PREVENTING ELECTROLYSIS.

having a square section at the base. In order to prevent any possible damage to the pipe from electrolysis from the electric railway lines in the vicinity, it is connected by bonded terminals spaced 8 ft. apart over its length to a large conductor running lengthwise of the pipe in the ground above it, as shown in Fig. 9. The interior of the pipe was cleaned by sand blasting and then covered with several coats of paint. All imperfect joints were carefully caulked. A striking reminder of the size of this pipe may be noted in the fact that its diameter exceeds the combined heights of three ordinary men.

On the cliff near Table Rock, above the power house, the 18-ft. conduit terminates in a distributor section. The trench for this section was excavated in solid rock, and through the limestone cliff beneath it four vertical shafts and horizontal tunnels for the penstocks were carried down to the power station in the gorge below. This distributor section is 260 ft. long, built up of steel plates ⅝ in. thick, stiffened with bulb tees and encased in concrete. It terminates in an overflow device and spill tunnel.

The distributor section delivers water for six generating units and a reserve and also provides water for two exciter units. The required amount of water for full-load conditions is about 3,800 cu. ft. per second, and the velocity in the 18-ft. main when delivering water at this rate is about 15 ft. per second. With this velocity the estimated loss of head in the 6,400 ft. of pipe is approximately 25 ft.

Six of the main penstocks leave the distributor section in pairs and descend vertically through the valve chambers and on to the bottom of the shafts at elevation 350, a drop of 156 ft. beneath the

FIG. 10.—CONSTRUCTION VIEW OF APPROACH TO OVERFLOW.

distributor. These penstocks are 9 ft. in diameter. A seventh penstock used for operation on either distributor No. 1 or No. 2 descends from the end of distributor No. 1 and crosses over diagonally and joins with the first penstock of the second distributor section,

which section has not as yet been constructed. Two exciter penstocks are taken off from the distributor at a point near the second pair of penstocks and descend vertically to a penstock and cable tunnel which enters the power house at an angle of about 30° from the horizontal.

The valve chamber is 16 ft. wide and 10 ft. high, extending the full length of the distributor section, the excavation for the conduit having been carried downward to provide this space for the penstock valves and the motors which operate them. Above this chamber the distributor section is supported by a continuous concrete arch. The shafts for the penstocks are 13 by 24.5 ft. in horizontal section, and are met at the bottom by tunnels of similar dimensions which lead into the generating station. The pairs of 9-ft. penstocks in these shafts and tunnels, with their centers 11.5 ft. apart are supported by concrete thrust blocks at the bottoms of the shafts, are centrally supported in the connecting tunnels, and again pass through concrete thrust blocks in entering the station. An expansion joint is inserted in the vertical leg of each penstock just below the valve chamber and in the horizontal leg a short distance from the thrust saddle at the elbow. These joints provide for any expansion or contraction of the penstock due to temperature change. From the center elevation of 357 ft. in the penstock tunnels the supply rises to the water wheels on the station floor above, of which the center elevation is 373 ft., or 133 ft. below the center of the main pipe line on the cliff above.

The inclined tunnel through which the exciter penstocks reach the generating station begins at a manhole about 57 ft. back on the bluff from the center of the 18-ft. main conduit and passes under it on the way down to the power house. There are contained therein not only the two 30-in. exciter penstocks, but also the cables for the main generators, and the control wires from the generating to the distributing station. Just before entering the power house the two 30-in. penstocks turn to a horizontal position and enter wheels with centers at elevation 380.8 ft. or about 125 ft. below the center of the distributor section.

A concrete tunnel at the end of the distributor turns upward to an open spill with adjustable crest over which the water passes to a spill tunnel. This spillway is so designed that a practically constant velocity will be maintained through the main conduit and abrupt changes in load will not result in a water hammer or any serious strain on the steel distributor section, but will affect only the height of discharge over the weir. The crest is built up of a series of stop logs and can be so adjusted that the flow in the main will be adapted to the requirements of any given number of units that may be installed at any time. A concrete structure finished with a rustic boulder facing will enclose the weir, and in external finish will present an appearance somewhat similar to that of the refectory building erected in the park a short distance below.

The discharge from the weir takes place through a helical tunnel, of steep initial pitch, which changes gradually in form from rectangular to circular as it leaves the weir crest. (See Fig. 10.) The helix makes approximately a three-quarter turn and preserves a smooth unbroken water column as it passes on through a 10-ft. pipe to the river. This discharge tunnel is designed to prevent erosion, restricted flow and excessive air suction on account of the danger in winter of the formation of ice from spray under forced circulation of air. The space between the pipe and the rock sides of the tunnel is completely filled with concrete.

THE POWER STATION.

A narrow ledge made by excavation of talus and limestone rock between the base of the 150-ft. cliff at Table Rock and the boiling Niagara Flood, a little below the foot of the Horseshoe Falls, is the site of the station that is ultimately to develop 200,000 electrical hp. The building itself, a cross-section of which is shown in Fig. 11, is an artistic concrete structure, low and massive, with flat roof, which appears as a jutting shelf from the cliff behind.

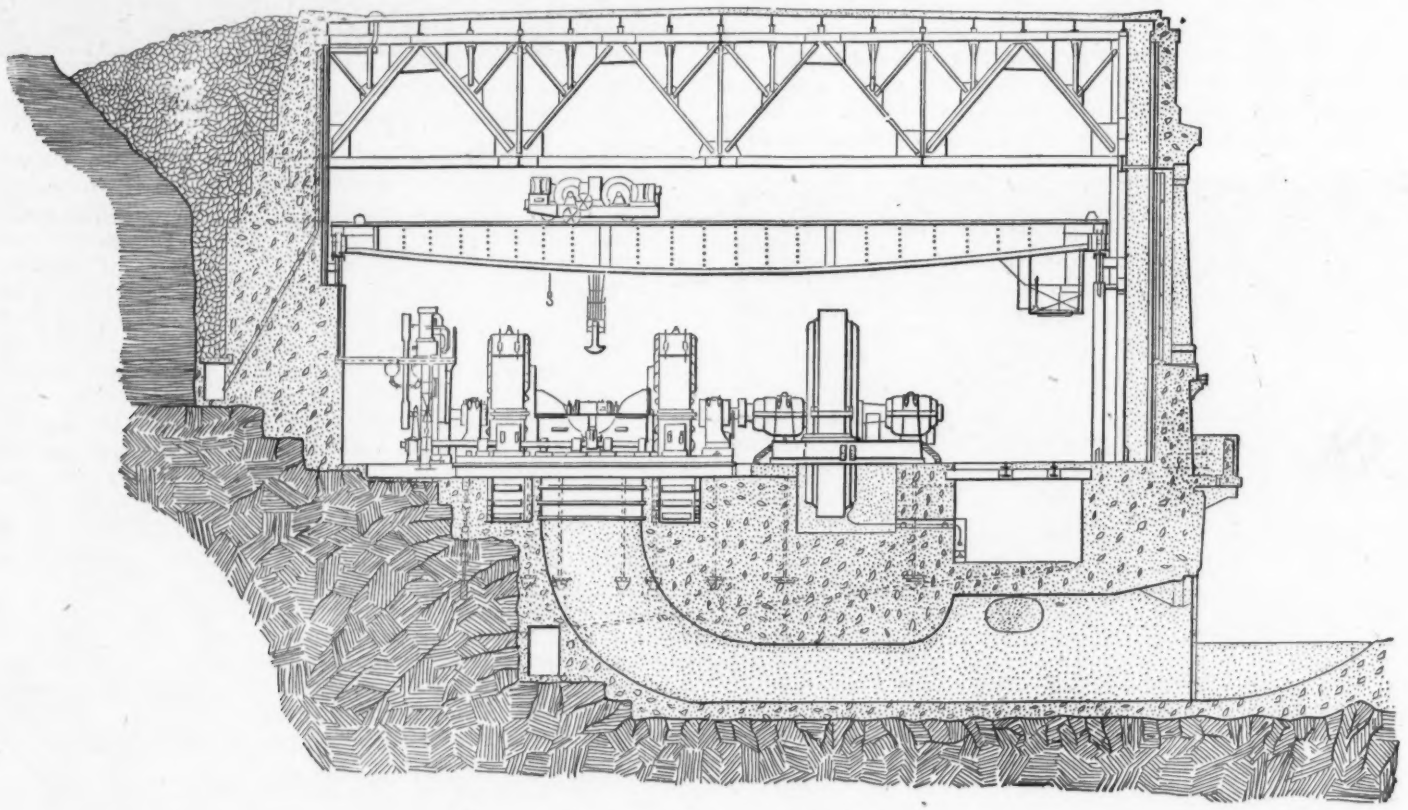


FIG. 11.—SECTIONAL VIEW OF POWER HOUSE.

The completed station will have an ultimate length of about 1,000 ft. and its width inside varies from 80 to 95 ft. The general plan of the station includes main generators, each connected directly to a pair of horizontal turbine water wheels so that the common shaft of the wheels and generators lies at right angles to the face of the cliff and river bank. On a gallery along the rear or cliff side of the station are located the exciting dynamos and their wheels, oil circuit-breakers for the main generator leads, a switchboard for the exciter and field circuits and a terminal board for the control wires. A service board for light and power distribution in the station and control of penstock valve motors is also placed on this gallery.

Each 9-ft. penstock runs to one pair of the horizontal turbine wheels which in turn drive a single electric generator. Upon entering the generating station the penstock divides into two parts, which go respectively to the wheels that form the pair. (See Fig. 12.) Each pair of these main wheels operates at 187.5 r.p.m., is rated at 11,390 hp, and when working at this rate requires about 636 cu. ft. of water per second under an effective head of 175 ft. As the elevation of

low water in the forebay is 553 ft. and the centers of the main wheels in the power house are at elevation 373 ft., the total pressure head down to this point is 180 ft. Draft tubes from the turbines pass down below the tail water level, which, at times of full load, rises to elevation 353. Between forebay and tail water the minimum difference of level is thus 200 ft., and a friction loss of head in the main line and at other points leaves an effective head of 175 ft. for the main turbines at full load.

The separate steel draft tubes from the turbines of each pair unite

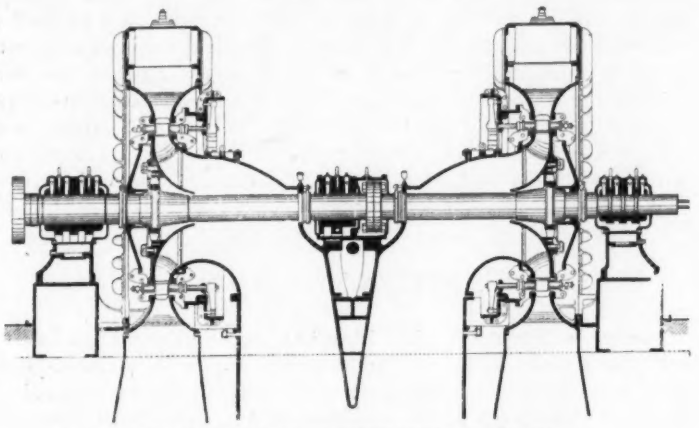


FIG. 12.—DETAILS OF HORIZONTAL TURBINES.

at about the level of the bed plate and there join an extension formed in the concrete foundation and pass to the open tail water. Niagara River below the falls, because of its narrow channel, is subject to large fluctuations in level, but any danger of flood from this source is avoided by a concrete barrier which extends to windows 10 ft. above the main floor level and nearly 35 ft. above the normal water level as above noted. Just outside of the station wall there has been constructed a concrete tail race with a weir wall between it and the river. The top of the weir wall is at elevation 349.5, or nearly 7 ft. above the normal river level, so that the level of tail water is not affected by any ordinary fluctuations in the height of the river surface. When all of the turbines in the station are operating under full load, the water in the tail race will rise so as to discharge with a depth of about 3.5 ft. over the outside wall into the river.

The generators are direct-connected to each pair of main turbine wheels through a horizontal shaft, as shown in Fig. 13. They are rated at 7,500 kw, 12,000 volts, 25 cycles and are of the three-phase type. Between the case centers of the pair of turbines on each shaft the distance is 17 ft. and this space is taken up in part by the draft tubes and a shaft bearing. At the tips of the runners of each wheel the diameter is 6.5 ft. The floor space occupied by each generator and its pair of turbines is about 49 ft. long in the direction of the shaft and 26 ft. 7¼ in. wide. For the generator above the

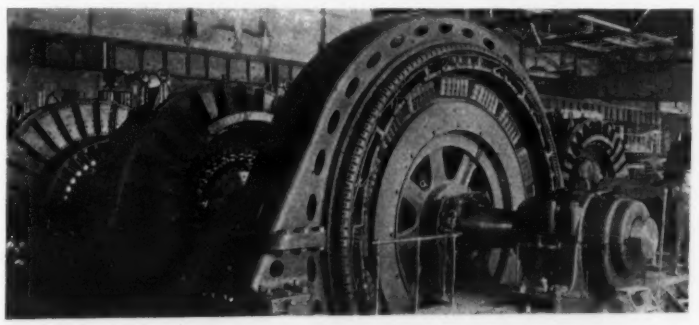


FIG. 13.—NO. 1 UNIT AS OPERATED IN JULY.

length of shaft from the center of coupling is about 20 ft. and the bed plate measures 26 ft. 7 in. at right angles to the shaft. The diameter of the generator shaft is 21 in., and the length of the cast-iron pedestal that carries the shaft bearing is about 5 ft. 3 in. These generators are of the rotating-field type with stationary armatures. The weight of rotating field including shaft, spider, punchings and coils is about 175,000 pounds. The diameter of the field is 15 ft. 2½ in., and the field consists of 16 poles.

The external armature frame of the generator measures 21 ft. 6 in. in diameter and divides into two parts horizontally, and the weight of the entire machine is about 421,500 pounds.

Two impulse turbines with their centers at elevation 380.8 or about 28 ft. above the high tail water level, are each direct-connected by a horizontal shaft to an exciter which operates at 300 r.p.m. Each exciting dynamo has a capacity of 500 hp, operates at 250 volts, and, when running at full load, its connected turbine is expected to utilize 50 cu. ft. of water per second. The runners of these turbines are overhung on the generator shafts. A single exciter unit is sufficient to supply the exciting current for the six generators, but two are supplied in order to provide for emergencies. Current from the exciters may be used to operate the electric crane and the control circuits of the oil switches for the generators and the transformers. Provision is made for supplying the local service from either the alternating or direct-current circuits. A storage battery to be installed will be used to operate the control circuits when necessary.

Over the main floor of the power house there is a 50-ton electric traveling crane with a lift of 30 ft. and a span between runway rails of 77 ft. 3 in. This crane has three direct-current motors for the hoist, trolley and bridge, respectively, in addition to which a high-speed, low-power hoist is provided. At full load the speed of the hoist is from 5 to 6 ft. per minute, of the trolley 75 to 80 ft. per minute, and of the bridge 150 ft. per minute. With no load the hoist speed is 12 to 15 ft., the trolley speed 90 to 100, and the bridge speed 200 ft. per minute.

Relations of the Central Station with the Public.

BY W. F. KINGAN.

PUBLIC utilities, such as those of lighting and street railway companies, stand out prominently before the public eye since almost every inhabitant residing in a small village of a great city has daily to come into contact with the product or conveniences offered by these companies. Consequently the policy and management of such corporations must be determined with great care to preserve good relations with the general public. As I take it, the policy of all such companies should carefully consider three main points, namely, duty to the public, duty to employes and duty to the stockholders. The first of these—duty to the public—will be noticed briefly in this article.

Never before in our memory has the press and public been stirred to such resentment and antagonism to trusts, corporations and the moneyed power as exist at the present time. This has come about by the unexampled growth in wealth of the country, the desire to get rich quickly, speculation, avarice and greed of individuals and great combinations of capital to control the necessities of life, which have created in the public a suspicion, to overcome which requires a definite policy on the part of those affected. Let a company ask a council for the renewal of a contract, the extension of certain lines or a renewal of a franchise and it is immediately made aware of the public state of mind just referred to. One fact is morally certain, public utility corporations are at heart desirous to have the public favor, to have it believe they are honest, that they are supplying the best product, that they are giving good service and charging a minimum amount for such service; nevertheless, the general public still remains suspicious. Is there a reason or reasons for such mistrust on the part of the public? There must be or it would not exist. The answer to this opens up the following questions:

Are we giving the best service; are we charging a minimum price for it; are we painstaking and anxious that every customer, young and old, small consumers or large consumers, receives from every official and every employe of the company the greatest degree of courteous treatment; that every request is met in a generous spirit and accorded the best compliance consistent with the interest of the company?

As to giving good service, What does this mean? It means that customers are supplied with the most efficient lamps or devices, that there is ever present at such devices, days, nights, Sundays and holidays an even and exact pressure, that all our work about the customer's premises is in accordance with neatness, good taste, security and safety; that customers are kept in touch with all the latest improvements in electrical devices, and their lamps periodically inspected and maintained clear and bright; that a constant campaign of education is maintained whereby customers are taught to see that in lighting the best effects are preserved with the greatest economy

in current, and in power; that the best engineering advice is tendered heartily and free to the end that each user of power shall have the best distribution of motors and machinery that modern engineering ingenuity can devise for flexibility, security and economy. These studies in engineering for lighting and power when systematically and consistently carried out for the benefit of customers will do more than anything else to hold and interest patrons and make them an advertising medium of great value.

As to selling at a minimum price, this is complied with if we are generating and distributing current with a minimum of fixed charges and operating costs per unit and do not add too much profit to these charges. The station should be located, if steam is used, where land is cheap, where coal and water can be secured at the least cost. The buildings should be plain but substantial, the machinery the most economical, comprising the fewest units and including the best labor saving devices; in short, simplicity, strength, economy, and a minimum of moving parts. This, with high-voltage, large transformers, finely built lines, conduits and house services afford the means and opportunity to generate and sell the poduct cheaply, not overlooking two other important points—load curve and profit added to the cost of production.

The load curve is one of the most important problems in the electrical business. If we could store electric energy as simply and as cheaply as the gas companies do their product, nearly all the kinks would be taken out of the business and the unending war to arrive at a plan of equitable rates for all would soon disappear. As it is, we at an immense expense install a plant to take care of the peak load of about two hours, and it practically lies idle the other twenty-two. This compels the companies to charge a high price for light, and to be honest with ourselves that we are selling our product at a minimum price, we must go out into the highways and byways and get business outside of this peak load, and not be satisfied until we have filled out the load curve to make it have the semblance of a straight line. After we have searched out all the dark places that require light in day time and connected them up, and exhausted the field for fan motors, cooking and heating devices and motors, then and not until then, have we fulfilled our trust to the people though leaving no stone unturned to be in a position to give the cheapest light possible.

As to profits to be added to the cost of production, it should be only necessary to state that after providing for a reasonable depreciation, for insurance, taxes, employes' and public liability, for maintenance and operating charges, a fixed return on the actual capital outlay should be charged, which should not exceed 8 per cent., and the price for power should decrease just as fast as the profits exceed this fixed policy.

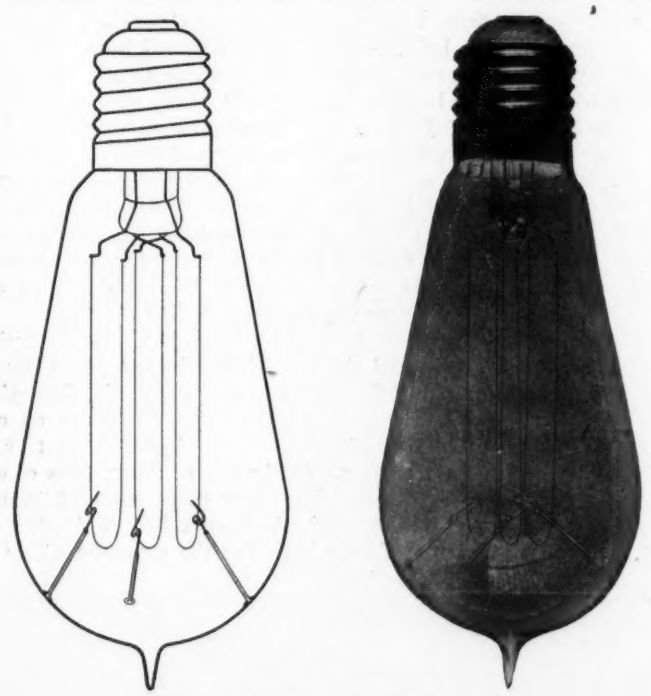
Third and finally, as to treatment of the public. This is a feature of company life that I fear receives scant notice, though one of the most vital to secure the co-operation and friendship of the public. Many companies assume an attitude similar to that of a victor in a conquered country. Officials are unapproachable, except through a line of guards, and an air of secrecy pervades; people are timid and suspicious, but pay their tribute because no other course is open to them. How they welcome a new company that arrives to do battle and give them freedom. Other companies are anxious to improve these conditions, but lack the necessary knowledge and tact. Men may be fine organizers, others clever at figures, and others are noted for their ability to keep down costs and improve production and output; but what every company wants is a good buffer, a man or woman of intelligence, discretion, address, good nature, patience, thoroughly understanding the company and its policy and whose desk is always accessible and convenient to the public who is always there to please, to humor to the utmost every whim or every customer who desires information or accommodation. Walk into a retail store on a good business street and you immediately meet an employe who asks smilingly what your requirements are and who is at once at your service; he will haul down everything in the store to show you and will send your goods home no matter how small or trivial. It is a constant study with them to show their goods to the best advantage, to please their customers and make them always at home in the store. These qualities the average corporate companies lack.

Information, adjustments of accounts and the thousand-and-one questions that arise daily are frequently turned over to young and inexperienced clerks who lack the tact and ability to straighten out complications affecting a company. It indeed would surprise one to know the extent to which this weak point is responsible for adverse criticism of lighting companies. Most people judge a company through the person they meet behind the wicket, and for this important position he should be one, who, like a good salesman, will bring business instead of turning it away.

The public demands the best service at a low cost. It grants valuable franchises and allows the streets to be torn up, undermined and planted with poles and the sky screened by wires and cables, and knows that it is the source of a company's prosperity. The company that desires to live in harmony and peace with its patrons must recognize its debt to the community that granted it corporate life and continuously supplies it with the sinews of war to maintain a profitable existence; it should give the people the best value for their money, have a policy and publish statements regularly; its contracts should be short and simple, with a minimum of strings attached, and it should endeavor to supply its customers with every device and every item of information that will improve the service and benefit its patrons.

The Osmium Lamp.

For some time the osmium lamp has been on the market in Germany and Great Britain, and the accompanying illustrations show this lamp as sold by the General Electric Company, Limited, of London. The lamp is the invention of Dr. Carl Ritter Auer von Welsbach, the inventor also of the incandescent gas mantel known in this country under the name of Welsbach mantel, and on the Continent under the name of the Auer mantel. The osmium lamp is



FIGS. 1 AND 2.—THE OSMIUM LAMP.

made by the Berlin firm which also owns the patents of Welsbach on incandescent gas lighting. The affiliated Vienna firm has ceased to manufacture the osmium lamp, drawing its supplies from the Berlin manufacturer. In England the lamp is sold under the trade name "Osmi" and the German trade name is "Auer-Os" lamp.

The illustration shows a 50-volt, 25-cp lamp, guaranteed at 1.5 watts per cp. The filament, which has an approximate length of 15 in., is divided into three separate loops which are connected in series by means of two loops of platinum wire, the middle of each of which is fused by means of a glass head to the top of the stem carrying the two leading-in wires. Each filament is anchored in order to prevent the loops from touching. The anchoring device consists of a small glass rod, to the end of which is attached a turn of small wire of white refractory material, as shown in the illustration. Formerly these anchor terminals were made of metal, but as it was found that the filament always parted at this point the refractory material was substituted. It will be seen that the filament is anchored, not at its extremity, but somewhat above the turn of the loop. The lamps can be burned only in a vertical position.

During the first 200 hours of burning, or thereabouts, there is a slight increase of candle-power due to particles of osmium being fused together by the current passing through the filament. At the end of this period the candle-power reaches a maximum and decreases afterward. It was at one time stated that the actual life of the filaments might be as high as 5,000 hours, but that the useful life is only 2,000 hours, by useful life being understood the time during which the candle-power maintains 80 per cent of its initial value. The English company, however, guarantees a life of only 500 hours at a consumption of 1.5 watts per candle.

The price of the osmium lamp in Germany is 6 marks (about $1.50) retail, and 4 marks (about $1) in quantity. A half mark (about 12 cents) is allowed in Germany for burned out lamps. The English company allows practically the same amount, namely, sixpence. To adopt the lamp to the usual 110 and 220-volt circuits—it is only made at present for 50 volts—the English company supplies adapters for connecting to a single socket two, three or more osmium lamps in series. The cost of these varies from 62 cents for two-way to $1.37 for five-way adapters. It will be recalled that the different stages of the development of the osmium lamp have been characterized by a constant increase of voltage, and it is reported that the Berlin company has succeeded in making 110-volt osmium lamps of 35 and 32 cp, though this type has not yet been put on the market.

Regulation of Electric Rates in Massachusetts.—I.

By Alton D. Adams, LL. B.

A PRECEDING series of digests deals with the leading decisions of the Massachusetts Gas and Electric Commission in regard to questions and disputes of gas rates, etc. The present series takes up in like manner the leading decisions relative to the regulation of electrical rates in Massachusetts. The digests are numbered for convenience of reference.

(1.) Mayor vs. Chelsea Gas Light Company.

Chelsea was the origin of the first petition for the reduction of electric rates by the Massachusetts Commissioners. This petition was signed by the mayor and certain citizens of Chelsea, and was filed January 29, 1890. At that time the Chelsea Gas Light Company operated the only systems of gas and electric supply in that city, and the petitioners sought a reduction in both of these lines of service. On May 6, 1891, the Commissioners announced their decision, and refused to reduce the electric rates. The meter rate in Chelsea was 1.25 cents per hour for the operation of an incandescent lamp of 16 nominal candle power, at the time of this petition. Street lighting was being done under a contract that fixed the rate per arc lamp of 1,200 nominal candle power at 30 cents per night for all-night service, and the rate per incandescent lamp of 25 candle power, operated until 12:30 a. m. on twenty-five nights per month, at $14 per year.

On June 30, 1890, the capital stock of the Chelsea company was $300,000, and there were notes of $65,000 out against it. At the end of the following June the amount of notes payable had increased to $70,000. The capital stock of the company had all been issued before the electric business was taken up, and was represented only by the gas plant. In the electric plant there was an investment of about $80,000 at the time of the hearings on the petition, and this sum had been obtained from loans and earnings. During the year ending June 30, 1890, the Chelsea company had a net income amounting to $3,370.49 from its sales of electric energy, and this sum is about 5.2 per cent of the loans of $65,000 that had been invested in the plant. For the year ending June 30, 1891, the net electric earnings of the company were $8,028.95, and this is a little more than 10 per cent of the investment in the electric plant at that time.

(2.) Mayor vs. Chelsea Gas Light Company.

Again, in 1893, the mayor of Chelsea and certain consumers of the Chelsea Gas Light Company joined in a petition to the Commissioners for lower gas and electric rates. Before the hearings on this petition were had the company reduced its meter rate from 1.25 cent to 1 cent per hour for the operation of each 16-cp incandescent lamp, and the petitioners waived their request for any further reduction of the electric rates. This reduction went into effect July 1, 1893. During the year ending on the previous June 30, the company had a net electric income of $9,651.85, which was 9.2 per cent of its obligations of $105,000 in bonds and notes.

(3) Consumers vs. Malden Electric Company.

In the latter part of 1894, the first case before the Commissioners that involved the regulation of electric rates came up. This case was based on the petition of certain consumers of the Malden Electric Company, in Melrose, for regulation of prices on electric lighting. Complaint was also made as to the quality of the service, but the company took measures to remedy the defects about the time of the hearings, and no order was made on this part of the case. On all except public lighting the Commissioners reduced the maximum meter rate from 1.5 cents per 16-cp lamp per hour to 20 cents net per kw-hour from July 1, 1894, and refused to make any order as to contract rates with private consumers. The rate of 20 cents was made to apply in the entire territory covered by the Malden company. Petitioners asked for no change in the existing contract rates for street lighting, and the Commissioners made none.

Payment of the bill not later than the 25th day of the month was the condition on which consumers were entitled to the net rate fixed. In 1888, the year of its incorporation, the Malden company bought out the other electric lighting interests in that city, and issued about one-fifth of its $180,000 of stock and bonds in payment for licenses and franchises. Before their decision as to rates, the Commissioners had the report of the Malden company for the year ending June 30, 1893. On that date the company had a capital of $150,000, its bond issue was $100,000, and its notes payable were $111,526.36, a total of $361,526.36. During the year ending on the date named, the company earned $73,891.82 by sales of electric energy, had operating expenses of $44,136.72, and net electric earnings of $29,755.10. Of this last sum $11,330 was paid in interest, leaving $18,425.10, or 12.3 per cent on the capital stock. A dividend of 8 per cent, amounting to $12,000, was paid. Because of the uncertainty as to the portion of the income of the company that was derived from sales of electric energy at the maximum rate of 1.5 cents per 16-cp per hour, it is not possible to say how much the rate of 20 cents per kw-hour would have reduced the income during the year in question. In the following year, ending June 30, 1894, the gross electric income of the Malden company was $85,723.32, and the net income was $36,064.90, from which $12,600 in interest was paid, leaving $23,464.90, or 15.1 per cent on the capital stock. On July 1, 1894, the rate of 20 cents per kw-hour went into effect, and during the following year the Malden company had a gross electric income of $88,372.50, which was reduced by expenses to $36,533.62 net. Interest payments reduced this latter sum to $22,000.64, or 14.1 per cent on the capital.

The Malden company had a connected load of 21 arcs and 8,569 incandescents in commercial service, besides 190 arc and 1,614 incandescent street lamps on June 30, 1893. At this same date the electric company in Cambridge had connected 42 arcs and 5,842 incandescents for private consumers and operated 444 arc and 93 incandescent lamps on the streets. The maximum meter rate charged by the Cambridge company was one cent per hour for a lamp of 16 nominal candle power. In Lynn private consumers had 200 arc and 5,562 incandescent lamps connected to the electric system, and there were also 372 arc and 1,240 incandescent street lamps. By meter, the maximum rate of the Lynn company was 18 cents per kw-hour.

The Malden company operated commercial lamps on both the contract and the meter basis, and the Commissioners said that contract rates were inequitable between the company and consumers, and between the consumers themselves. Charges for street lighting were only about one-third as great as the meter rate per unit of energy, and this was said to be poor business policy.

Subsequent to its purchase of the property and rights of other electric companies, the Malden company had issued all of its stock for cash which was interested in its plant, but it had paid dividends from the beginning and had charged off nothing for depreciation. To the cost of generating and distributing electric energy, the Commissioners said that the item of depreciation must be added, and that dividends ought not to be paid with money needed to cover depreciation. On petition of the company, the latest date for payment of the net meter rate was changed to the 15th of the month.

(4) Selectmen vs. Woonsocket Electric Machine & Power Co.

By a special Massachusetts act of 1890, the Woonsocket Electric Machine & Power Company, a Rhode Island corporation, was authorized to acquire pole locations and construct electric lines in the town of Blackstone, in the former state, and was made subject to the Commissioners. Reports of the operations of the Woonsocket company do not appear, however, in the reports of the Commissioners.

In the first half of 1895 the selectmen of Blackstone petitioned the Commissioners to reduce the rate charged by the Woonsocket company for street lighting in their town. At that time the company was operating 29 arc street lamps of 2,000 nominal candle power each, all and every night. After a hearing the Commissioners fixed the rate at the maximum of 42 cents per lamp per night, or a lower rate if lamps of less candle power were used. The generating plant of the company was in Woonsocket, and its load there was much larger than that in Blackstone. A fair rate for lighting by the company in Blackstone was said by the Commissioners not to depend on what could be done by a small plant located there and operating only the local service. On this point the Commissioners also said: "A fair price for service in the town of Blackstone will be the fair general cost to the Woonsocket company for manufacture and distribution, including taxes and management, with an added amount ample to pay a fair dividend upon such a percentage of the capital fairly required for the entire electric business of the company as the volume of the Blackstone business bears to the entire business of the company." During the year ending June 30, 1894, for which the reports of the electric companies were before the Commissioners when they fixed the Blackstone rate of 42 cents per lamp per night, only two other places in the state were paying more than 40 cents per arc lamp per night for street lighting. The rate fixed for Blackstone was to go into effect on July 1, 1895, but the Woonsocket company refused to accept it, and notified the town and the Commissioners that the street lamps would be discontinued when the existing contract expired on the 15th of the same July. On August 15th following, the Commissioners issued an order, after a hearing on a petition by the selectmen, requiring the company to continue the operation of the street lamps at the rate fixed. The company neglected to comply with this order, and the attorney general brought suit in equity to compel the company to obey. Before the case came to a hearing in court, the town advertised for bids for street lighting, and contracted for the operation of its lamps with a new local company. This Blackstone company undertook the operation of 29 arc street lamps of 2,000 nominal cp on an average of 10.1 hours every night for $140 per year, or 38.3 cents per night. Poles and wires of the Woonsocket company were removed from the streets of Blackstone before the end of the year.

(5) Selectmen vs. Milbury Electric Company.

A petition for a reduction in the price and improvement in the quality of the street lights was presented to the Commissioners by the selectmen of Millbury in 1896. The Millbury Electric Company was then operating 33 arc lamps of 1,200 nominal candle power, and 6 incandescent lamps of 32 cp each, on the streets of that town during 1,374 hours per year, at the annual rate of $75 for each arc lamp and $20 for each incandescent lamp. After a hearing the Commissioners reduced the total amount payment to be made by the town for the lamps just named to $2,375, and said that three of the incandescent lamps should be treated as one of the arcs in all computations. On this basis the price fixed by the Commissioners amounted to $67.85 for each arc or for three incandescents. For additional arcs to the number of not more than seven the Commissioners fixed the rate at not more than $44 per lamp annually, and for any decrease in the number of lamps the yearly reduction per arc was to be $14.50. In case of a total failure of any lamp a pro rata rebate was to be made. These rates went into effect on December 28, 1896, the date of the decision. On June 30, 1896, the capital stock of the Millbury Electric Company was $17,000, and it had bonds of $16,000 and notes of $700 outstanding. During the year ending on the date just named the company had a gross income of $5,911.87 from its electric business, the operating expenses were $4,110, and the net income $1,801.87. In this same year the interest paid was $1,037.95, and this deducted from the net income left $763.92, or 4.49 per cent on the stock. The rate of $67.85 for each nominal 1,200 cp arc, 1,374 hours per year, as fixed by the Commissioners, amounts to 15.2 cents per kw-hour, on the assumption that each lamp received 330 watts. During the year the town of Bridgewater paid $70 for each of 35 nominal 2,000-cp arcs operated 1,132 hours on its streets. Assuming that these lamps absorbed 480 watts each, the price paid by Bridgewater was 12.8 cents per kw-hour. In reaching their decision the Commissioners said that those engaged in a public service are entitled to a reasonable return on their investment when the business is properly conducted, "but are not entitled, for the sake of such return, to impose upon a community additional burdens on account of careless or incompetent management." At the rate fixed it was said that a reasonable profit could be expected only after the company had substantially improved its methods, and this rate was intended to yield only a fair return on the capital required to erect a plant in a town like Millbury. Several changes and removals of the lighting plant had involved large losses, and had greatly reduced or entirely extinguished the value of the capital stock of the company. Investigation showed that much of the commercial lighting at contract rates yielded little or no profit.

Practical Information on Central Station Meters.

The greatest space occupied in the "Question Box" of the National Electric Light Association is that containing queries and answers relating to meters, no less than 63 pages being taken up by this department in the answer of 36 queries relating to all phases of the subject. The great diversity of opinion existing among practical men is shown most strikingly in the answers. Local conditions naturally are responsible in part for contradictory answers, but the conflicting opinions expressed without any statement of the conditions underlying them detract very materially from the value of the "Question Box."

Several queries to problems relating to prepayment and slot meters brought forth 12 answers. One central station man states that his experience with prepayment meters has been quite satisfactory; another that they are proving very valuable in building up a certain class of business, while a third said that his experience had been unsatisfactory, and a fourth reported that the largest gas companies are discontinuing their use. As to the effect on sales of slot meters, three replies stated that they increase sales, and a fourth gives the advice "Better put in a regular meter." Concerning the advisability of installing such meters for any consumer who wishes to have one, or to confine their use only to doubtful customers, two replies are to supply any customer who wants such a meter, and another that the largest field is in apartment houses.

No less than 32 answers were received to the very general query, "How to satisfy a customer that his meter registers his consumption properly." The gist of the replies is to show the customer how to read the meter, to explain to him what readings signify in lamp hours and dollars and cents, and to advise him to test the meter himself by burning a given number of lamps a certain period of time and noting the reading. Additional advice is to show that jewel wear makes a meter run slow; to test the meter in the presence of the consumer by reference to another meter of known accuracy; to have the meter tested by a competent and impartial outside party; to test the meter in the consumer's presence with a portable ammeter and voltmeter; to install a recording wattmeter which indicates the number of lights burned at different times and how long they burn; to have fitted up in the office a meter with as much of the interior visible as possible and so connected or cut off at will, the consumer being invited to see the operation of the meter under the various loads and satisfy himself that it does not register without load; to send out pamphlets giving instructions for reading meters and for making approximate tests as to their accuracy; to encourage customers to read their own meters and to compute their bills.

Answers to the number of fourteen are offered to the query, "What effective means if any have been found to make it impossible for a customer to beat a recording wattmeter, or what special precautions can be taken by electric light companies to detect the same?" Among the remedies offered are inspection and systematic testing at regular intervals, most of the answers dwelling upon this means; running both leads into the meter with a shunt or crossed connection under the case; placing another meter for a period on a service pole as a hint to the suspected thief; keeping the main cut-out and service block as widely separated as possible; connecting direct to service wire or running leads in iron conduit to meter; enclosing the meter in a strong wooden box; locating closely-rated enclosed fuses in

enclosing wooden box; use of an all-glass cover; to require employes to report and watch suspected cases, reading the meters frequently; to require bookkeeper to report abnormal reductions in bills.

Eight opinions are expressed as to the percentage variation of meter readings allowable from no load to 50 per cent overload. Five favor two per cent, two three per cent and one "Not more than six per cent." The latter reply is from "Unsigned," and judging from the pessimistic views expressed on other topics over this signature it appears to conceal the identity of one who has a grudge against the public, and who might well have been debarred from the company of the other 226 contributions to the "Question Box" who stand openly for their opinions. One opinion favoring two per cent allowance suggests five per cent for commutator meters from no load to 10 per cent load, and another allows five per cent for starting load.

On the matter of granting a rebate to a customer whose meter has been found to creep, out of 26 replies, 19 favor doing so, though some point out that an admission that a meter is incorrect may in cases prove damaging; three replies are noncommittal and three are in the negative, including "Unsigned," who advises "Explain that the creeping has been effective only during the hours that the meter was idle (!), and that the result of the creeping during the month has an insignificant money value."

The effect on an alternating-current meter of a 10 per cent change in frequency was the subject of 10 replies. Of two opinions without qualification, one was that the meter would run slow at a smaller and high at a greater frequency, and the other that the effect would be exactly the reverse of this. Three others state that induction wattmeters ran slow on higher, and fast on lower, frequencies; four replies are that there is no appreciable difference, and a fifth that "the meter will probably creep."

The reason why a slight vibration during 12 out of the 24 hours causes a meter to run slower was the subject of 26 replies, of which 22 ascribed the cause to abnormal wear on the jewels and pivot, and four to sparking at the brushes in the case of a direct-current meter, which roughens the commutator.

Considerable diversity of opinion was expressed in reply to the query, "How often should consumers' meters be tested?" Of the 21 answers, the majority favored yearly testing, in some cases with the qualification that large meters should be tested several times annually. One advocated monthly tests, another quarterly and several half yearly tests. One answer was that a commutator meter should be tested every four months, but that once in two years was sufficient for an induction meter, while another assigned nine months for the former and eighteen months for the latter case. One opinion was a test for every million revolutions. Several replies indicate that those answering had no fixed rule.

There was similar lack of agreement in reply to the question whether meters should be tested on consumers' premises or carried to a test room. Of 20 answers, seven favored removal and testing at the station. The other thirteen advocated testing in place, several making the reservation that if needing recalibration or repairs the meter should be removed.

Eighteen out of twenty answering the query, "Should a charge be made for testing a meter at the request of a consumer," are decidedly in the negative. Of the other two one believed that the customer should be charged if a meter ran slow and another that he should be charged "With amount meter was slow." Some of the answers as to the best method of testing recording meters on the customer's premises went into considerable detail. Three recommended the use of the Sangamo testing set, consisting of a number of non-inductive resistances by which the load can be directly varied from about 10 watts to 200 watts, and then by means of a small current transformer for loads up to 3,000. A convenient method is stated to be a portable box giving different loads from 40 to 1,500 watts, in connection with a portable recording wattmeter with a dial that registers revolutions. Other methods are the use of a wattmeter and stop watch together with a calibrated resistance or lamp bank, for which latter the customer's lamps may be used; the use of an ammeter and voltmeter with the customer's lamps for a load; a portable lamp bank of six 100-cp lamps arranged to burn two in series on 220 volts or all in multiple on 110 volts; a registering standard wattmeter of a known degree of accuracy in series with a customer's meter; a standard recording wattmeter of the multiple-field type; the use of a resistance coil wound in tubes, each tube consuming 100 watts. Of seven answers to the query, "Are commutator type recording wattmeters correct for inductive loads?" four are in the affirmative without qualification, and one in the negative without qualification. One answer is that they are correct with power factors over 0.75, and another that the commutator type of wattmeters is not correct for inductive load, but that a properly constructed induction wattmeter with the compensating arrangement is correct on inductive loads of very low power factor; and four answers are that the type of meter in question is not correct on inductive load unless lagged.

All four answers to a query as to the relative status of the watt-hour meter as against the ampere-hour meter, favor the former, one stating that the latter is a thing of the past. A query as to whether the commutator type of meter has proved nearly equal to the best class of induction meters in alternating-current work, received sixteen replies, of which ten are in the negative. Of the five dissenting replies, four favor the commutator type without reserve, and the fifth also favors it with the qualification that if given the same amount of care in the way of periodic inspection it is equal to the induction type. Nothing new is brought out in a number of replies to a question as to what points are to be considered in deciding what make of meter to use in order to get the best results. The few replies given to a request for a cheap and accurate way of determining the flux density of wattmeter permanent magnets, indicate that there is no cheap method and that an accurate method is complicated. The concensus of opinion brought forth by a question as to the kind of damage to which a meter installed in the open air is exposed, was that they are subject to deterioration from the effects of moisture, which causes corrosion. Several condemn the practice of placing meters outside of buildings.

The question as to which of two single-phase meters used on a three-phase circuit should run more slowly brought forth four replies, three of which indicated that the writers did not appreciate the problem. The fourth gave the conventional three-phase vector diagram to show the phase relation of the currents and voltages, and thus explained the torque acting upon each meter.

There is a single reply to a query as to the average annual cost of maintenance of meters, which gives the figure of $1.33 for direct-current meters and 40 cents for alternating-current meters. A query as to what percentage of the investment in meters would be reasonable for the expenses of a meter department having charge of 1,000 meters received three replies, one of which named 5 per cent, another 6.5 per cent, and the third 10 per cent.

Twelve answers are given to a question asking the practice in regard to arranging with wiring contractors as to the location of meter loops. In eight cases the companies have rules regulating the matter to which contractors are required to conform. The rule of two other companies is that if meters are not located where they are accessible to meter readers, meters will not be installed, and one answer is that no satisfactory arrangement can be made with wiring contractors. As to whether a peep-hole in a meter cover induces a consumer to tamper with a meter, three answers are in the affirmative, and five in the negative. The query, "Do repolished meter jewels and pivots give as good service as new ones?" receives two replies, in the affirmative, two in the negative and a fifth that for certain conditions practically as good results may be obtained with repolished jewels, although a closer system of inspection may be required. The best place to locate a meter in a private residence is, according to seven replies to a query on this point, in the cellar or basement. Two prefer the attic, two prefer the kitchen and one favors any place where the reader can see the dial without the use of a light or ladder.

Fifteen replies as to the advisability of employing a meter man where there are 300 to 500 meters in use are unanimously in favor of having an experienced meter man on the station staff. As to the number of men required to handle a meter department of a station having 1,000 customers, two replies state that two men will be required; one says that several will be necessary, and five others that one man can attend to 1,000 meters. In one reply it is stated that one man can do all the reading and that if alone he can "go about quicker and will become more accurate." A company operating a 500-volt, direct-current, two-wire circuit for power loses from 10 to 15 meters in the spring from lightning discharges, although the lines, motors and meters are protected by lightning meters, and asked for a remedy. Of eight replies received, only two are to the point. One of these advises that the meters be grounded, and the other recommends insertion of heavy reaction coils in both lines between the arrester and the meter.

Tests of the Tantalum Lamp.

As noted briefly last week, Prof. Wm. Ambler read a paper before the Ohio Electrical Association giving the results of tests made on two tantalum lamps, one having a clear and the other a frosted globe.

The first test was on the change of resistance with change of voltage at the terminals of the lamp. In Fig. 1, curve *T* is that of a tantalum lamp, and curve *C* that of a 3.1-watt carbon filament lamp, each rated at 110 volts. These curves show that the tantalum filament increases in resistance with an increase of voltage, and, therefore of current and temperature, while the resistance of the carbon filament decreases as the temperature increases. The bearing of the increase in the resistance of the filament in the tantalum lamp on the change in candle power with the voltage is considered in detail later.

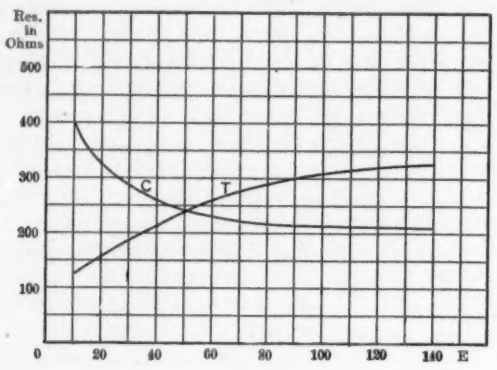


FIG. 1.—VARIATION OF RESISTANCE WITH VOLTAGE.

Measurements were made on the distribution of light from the tantalum lamps with both clear and frosted bulbs, and comparisons made with the light distribution from a 16-cp, 110-volt lamp with clear bulb and with a single-curl carbon filament. The horizontal distribution of light from each of the tantalum lamps was found to be practically uniform. The lamp with the clear bulb gave 22.0 for the value of the mean horizontal cp. The current at the rated voltage, 110, was .35 ampere, making 385 watts, or 1.75 watts per mean horizontal cp. The frosted lamp gave a mean horizontal cp of 19.8 watts and took .36 amp. at 110 volts, making 396 watts and 2.0 watts per candle. The rating given on the lamps is in the German or Hefner units, one unit of which amounts to .88 of the English unit of candle power. Values of candle power are given throughout in English units.

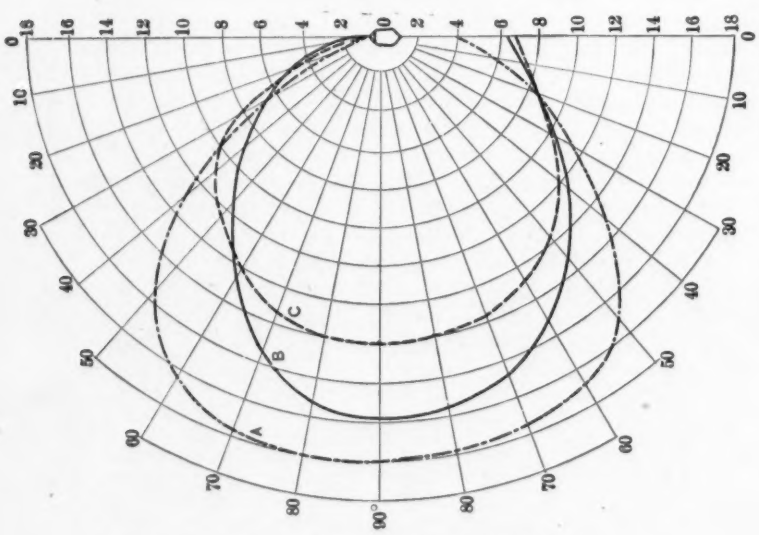


FIG. 2.—VERTICAL DISTRIBUTION OF ILLUMINATION.

In Fig. 2 are given the curves showing the vertical distribution of light from the three lamps. Curve *A* is of the tantalum lamp with clear bulb, curve *B* of the tantalum lamp with frosted bulb, and curve *C* for the carbon-filament lamp. Data for these curves were obtained by taking measurements of candle-power every ten degrees from the horizontal. While the tantalum lamps give much more light in a horizontal direction, the amount from the tip of the lamps is much less than that from the carbon filament lamp, though this is one with a single-curl filament. The tantalum lamp with the frosted bulb gives a much better distribution of light than the one with the clear bulb, as shown by the curves.

The mean spherical candle-power of the tantalum lamp with clear bulb was 17.2, requiring 2.23 watts per mean spherical cp. The frosted lamp gave 14.82 mean spherical cp, at 2.67 watts per candle. The carbon lamp gave 13.32 mean spherical cp, requiring 3.72 watts per candle. Comparing these values we find that the tantalum lamp takes 57 per cent and the frosted lamp 64.5 per cent, as many watts per horizontal candle power as the carbon lamp. The carbon-filament lamp has a consumption of 3.1 watts per horizontal cp. Also, the tantalum, with clear bulb, takes 60 per cent and the frosted lamp 72 per cent as many watts as the carbon lamp per spherical cp.

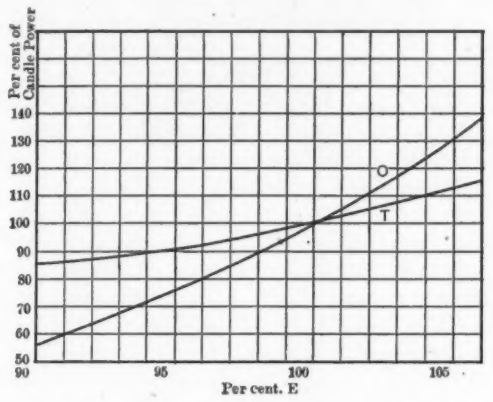


FIG. 3.—VARIATION OF ILLUMINATION WITH VOLTAGE.

Measurements were next made to determine the variation in the candle power with the voltage. The results are shown in the form of curves in Fig. 3. Values in per cent of normal voltage were taken as abscissae, and values in per cent of normal candle power as ordinates. Curve *T* is for the tantalum and curve *C* for the carbon filament lamp. The curves are similar, but the curve for the tantalum lamp is more nearly horizontal, showing that the change in candle power is much less than that of the carbon lamp for the same change in voltage. An increase of 4 per cent in the voltage caused an increase of 24 per cent in the candle power from the carbon lamp, while the same increase in voltage caused only a 9 per cent increase in the candle power from the tantalum lamp. It requires practically twice the percentage change of voltage across the tantalum lamp as that across the carbon lamp to cause the same change in light. This wide difference in the variation of candle power with voltage is due to the decrease in resistance of the carbon filament, and the increase in resistance of the tantalum filament with the increase in voltage.

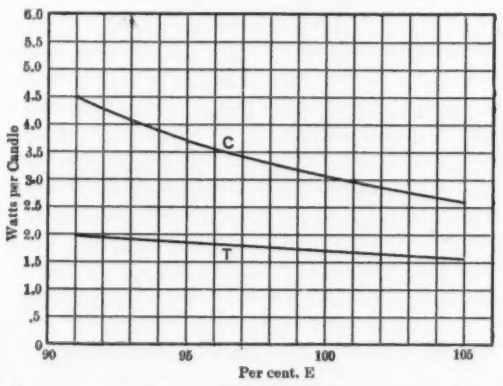


FIG. 4.—VARIATION OF SPECIFIC CONSUMPTION WITH VOLTAGE.

Fig. 4 shows the variation in consumption with the voltage. Values of watts per candle are taken as ordinates and per cent of normal voltage as abscissae. Referring to the curve *C* for the carbon lamp, it is seen that an increase in voltage of 5 per cent will cause a decrease in the number of watts per candle from 3.1 to 2.62, an increase in efficiency of 30 per cent. The same increase in voltage across the tantalum lamp would cause a decrease in watts per candle from 1.75 to 1.62, an increase in efficiency of about 12 per cent. With a de-

crease in voltage there results a corresponding decrease in efficiency.

The relation between candle power and life of the carbon and tantalum lamps is shown in Fig. 5 by the two upper curves. Candle-power values are taken as ordinates, and time of burning in hours as abscissæ. The curve for the tantalum lamp was the average of three lamps, the curve for each lamp differing only slightly from the average. The curve for the carbon lamp is the average of a large number of 3.1-watt lamps. During a life of 1,000 hours the tantalum lamp decreased in candle-power from 22 to 15.8, while the carbon lamp decreased in candle power from 16.5 to 11.5. This amounts to about 28 per cent in each case. These results show then that the falling off in the candle power of the tantalum lamp is practically the same as in the case of the 3.1-watt carbon lamp.

The two lower curves in the same figure show the change in consumption with life. The watts per candle taken as ordinates were obtained at the same time as were the measurements for the two upper curves. During the 1,000 hours the watts per candle increased from 1.75 to 2.4 in the case of the tantalum lamp and from 3.1 to 4.2 for the carbon lamp. This increase amounts to 37

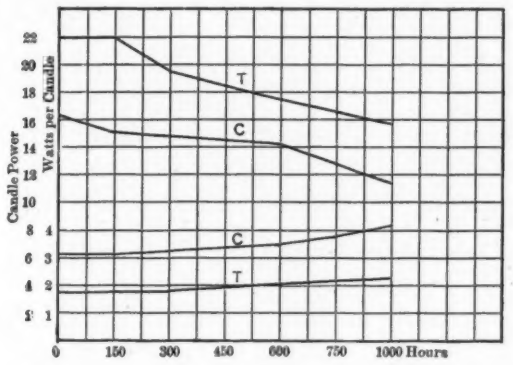


FIG. 5.—LIFE TESTS OF TANTALUM AND CARBON LAMPS.

per cent for the tantalum and 33 per cent for the carbon lamp. If we multiply the watts per candle by the corresponding candle power we find that the power taken by both the tantalum and the carbon is practically constant during the life of the lamp, a slight decrease occurring in each case.

In regard to the cost of the tantalum lamp, the representative of the German owners states that the lamps have not been placed upon the market in this country and that consequently no figures on the cost here are available. The cost of the lamps in Germany in barrel lots is 80 cents, as compared with about 16 cents for the ordinary lamp. Assuming this same relation between values to hold in this country, some comparisons were made. The useful life of each lamp may be taken as 500 hours. The average candle power for that time is 19.87 for the tantalum lamp with clear bulb, 17.88 for the tantalum lamp with frosted bulb, and 15.37 for the carbon lamp. The average watts per candle are 1.86, 2.12, and 3.25 respectively. Assuming energy at 10, 5, and 3 cents per kw-hour, the relation in cost can be expressed as follows:

Cost of energy per unit	$.10	$.05	$.03
Tantulum lamp, clear bulb	$.80	$.80	$.80
Energy for 500 hours	1.85	.93	.62
Cost of lamp and energy	$2.65	$1.73	$1.42
Tantulum lamp, frosted bulb	.80	.80	.80
Energy for 500 hours	1.90	.95	.63
Cost of lamp and energy	$2.70	$1.75	$1.43
Carbon lamp	.16	.16	.16
Energy for 500 hours	2.50	1.25	.83
Cost of lamp and energy	$2.76	$1.41	$.99

Dividing the cost in each case by the average candle power we obtain the relative cost and saving or loss by the use of the tantalum lamp. Taking the cost of energy as 10 cents per unit, 2.65 ÷ 19.87 gives the cost per candle for 500 hours for the clear tantalum lamp as 13.3 cents. This amounts to a saving of 26 per cent over the carbon lamp; 2.70 ÷ 17.88 gives the cost per candle for 500 hours for the tantalum lamp with frosted bulb as 15.1 cents. This amounts to a saving of 16 per cent; 2.76 ÷ 15.37 gives the cost per candle for 500 hours for the carbon lamp as 18 cents.

Carrying out the work in the same manner when energy is taken at 5 cents per unit, we find that the saving by the use of the tantalum lamp with clear bulb over the carbon lamp is 5.2 per cent.; by the use of the frosted tantalum lamp there is a loss of 6.7 per cent. With energy at 3 cents per unit, there is a loss of 11 per cent by the use of the clear tantalum lamp, and a loss of 23 per cent by the use of the frosted lamp.

These results show that there will be a saving by the use of the tantalum lamp only when the cost of energy is above or about five cents per unit.

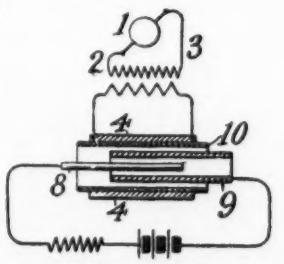
If we speculate upon the possible value of this new lamp we should consider the value of burned-out lamps. Allowing 50 per cent. of the original cost as the value of the lamp there will be found to be a saving when worked out as above of 35 per cent in favor of the tantalum lamp with the clear bulb with energy at 10 cents per unit. With the energy at 5 cents, the saving amounts to 31.5 per cent., and at 3 cents, to 13.5 per cent.

In conclusion, Prof. Ambler stated that it is evident that the success of this lamp will depend upon the ability of the makers to reduce the selling price of the lamp. There seems to be a probability of this in the direction of improved chemical and physical methods of manufacture, as the present high cost is due not so much to the value of the raw material as to the difficulty of working the metal into a fine wire.

Recent Electrochemical Developments.

ELECTRIC FURNACE.

The object of a patent recently granted to Henry Noel Potter is to produce at will any temperature intermediate between the usual temperature of an electric resistance furnace and that of an arc furnace. For this purpose he employs what is essentially a combination of a resistance and an arc furnace, the arc being produced between two electrodes within the resistance furnace itself. The inventor emphasizes the fact that under these circumstances the electric current will pass the gap at a lower voltage than is required under atmospheric pressure or under conditions of moderate heat. One of the applications of this principle, as applied to a tube furnace, is shown in the illustration. The tube furnace, 4, is supplied with alternating current from the transformer, 2, fed from the alternator, 1; simultaneously direct current is passed through the air gap between 8 and 9. With a modified design it



ELECTRIC FURNACE.

is, of course, possible to use the walls of the tube furnace as one pole of the arc-gap.

ELECTROLYTIC PROCESS.

Two patents recently granted to John R. Parks refer to method and apparatus for extracting precious metals from ores. He first subjects the ore to mechanical treatment so as to collect the greater proportion of the precious metals in slimes for electrochemical treatment. When separated from the slimes there are obtained only the clean, coarse particles of mineral, which are not amenable to economic treatment by cyanide, and the values of which are subsequently recovered by smelting. The slimes are treated by an electro-cyanide process with a simultaneous supply of compressed air and agitation of the pulp.

H. Schuessler patents mechanical details of an electro-plating device specially designed for coating sheet-metal plates. The plating tank has an inclined bottom with a carrier for the plates moving longitudinally.

ELECTRIC DISCHARGES.

A new application of producing chemical effects by means of electric discharges is described in a patent of A. de Hemptinne for converting oleic acid into stearic acid and other similar compounds whose melting point is higher than that of olein. The process consists in subjecting the oleic acid to the action of effluvia in an atmosphere of hydrogen.

BATTERY INVENTIONS.

In his nickel-iron battery T. A. Edison embeds the active material in small pockets of perforated nickel-plated sheet steel. For the purpose of keeping the weight of the battery as low as possible, the sheet steel must be very thin. On the other hand, it must be thick enough to give the desired elastic pressure so that the walls of the pocket are always in elastic contact with the active material. Edison experienced the difficulty that if the steel was made of sufficient thickness for the latter purpose, it could not be perforated in practice with the desired fineness, since the dyes became quickly worn out. For this reason he now uses steel thin enough to be readily perforated—about 0.0025 inch in thickness—and applies a greater thickness of plating of nickel than formerly—between 0.0005 and 0.00125 inch.

L. Langelaan patents mechanical details of construction of plates of active mass of lead cells, composed of single pieces and enclosed and held together by a protective envelope.

G. K. Hartung endeavors to avoid the use of metallic grids for supporting the active material in plates of the pasted type. He places the active material in expansible tubes mounted in frames and electrically connected to the terminals of the battery. The tubes are of non-conducting, acid-proof material, and carbon rods are embedded in the active material to conduct the current to the active mass.

D. L. Winters patents a copper oxide electrode for primary batteries in which an active mass of copper oxide is embedded in a zinc-coated perforated sheet-iron case. The coating of zinc is employed to set up local electrochemical action at the initial immersion of the plate in the electrolyte.

New York Central Third Rail.

Naturally, the matter of the type of third rail to be adopted for the New York Central electric traction system has received close attention on the part of those who are to make the selection. Extended tests with various types of third rail construction were made on the Schenectady experimental track, and finally after a thorough study of the subject by the New York Central Traction Commission the under-contract type shown in the accompanying illustrations has been adopted. The system is the joint invention of Mr. W. J. Wilgus, fifth vice-president of the New York Central Railroad Company, and Mr. Frank J. Sprague, who is a member of the New York Central Electric Traction Commission. The working details of the system, including a complete system of

FIG. 1.—TRACK SHOWING THIRD RAIL ERECTED.

crosses, switches, approaches, etc., have been developed under the direction of Mr. E. B. Katte, electrical engineer of the New York Central.

As will be noted in the illustrations, the third rail is supported every 11 ft. by iron brackets, which hold the insulation blocks by a special clamp. The blocks, which are in two pieces, are 6 in. long by ¾ in. in thickness, and are designed so as to be interchangeable. Experiments are now being conducted with insulators of reconstructed granite, vitrified clay, rubber and indurated fibre to determine the relative advantages of these materials for the conditions under which they would be used. Between supporting brackets the upper part of the rail is covered by wooden sheathing. This sheathing, as shown,

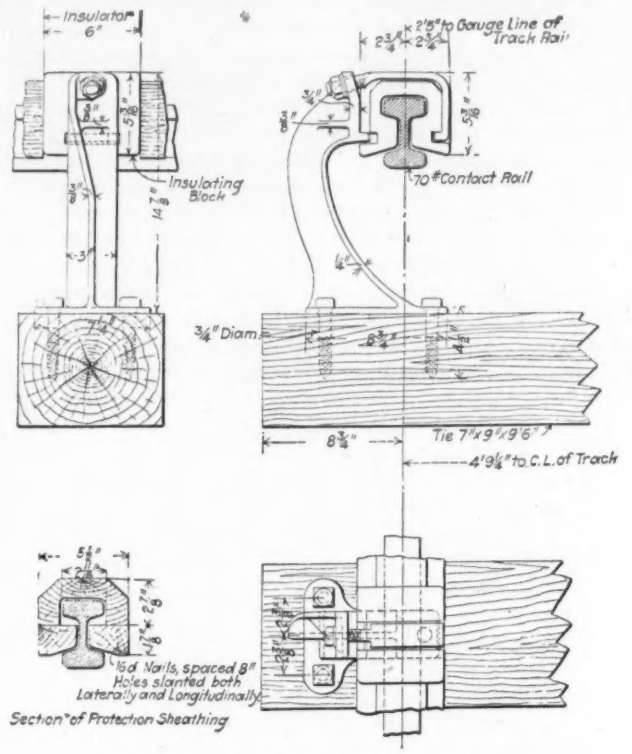


FIG. 2.—DETAILS OF THIRD RAIL CONSTRUCTION.

is applied in three parts, which are nailed together. At the joints where the third rails are bonded, and at the feeder taps, the wooden sheathing is mortised.

The third rail is not mounted rigidly in the insulators, but is given a little play for expansion and contraction, except at certain central points, where it is anchored. It weighs 70 pounds per yard, is of special section and composition, and has a resistivity between 7 and 8 times that of copper. Fig. 1 shows a section of track near Schenectady equipped with the new and old systems.

To afford the same clearance as would be permitted with a top-contact protected third rail, such as used on the Long Island Railroad, the New York Central third rail requires a location of from ½ in. to ¾ in. further out, but to secure a wider clearance, the New York Central engineers have decided to place the rail 1½ in. further from the gauge line, or a total of 29 in. This difference will not preclude the interchange of equipment with a suitable shoe which can be arranged so as to pass automatically from the under-contact to the top-contact third rail, and vice versa. The under surface of the New York Central third rail is 2¾ in. above the top of the service rail, while the upper surface of the Long Island third rail is 3½ in. above the top of the service rail. This difference can be taken up automatically by the spring pressure due to the shoe sliding on its under and upper surface in each respective case.

The principal reason for adopting the under-contact rail is that it can be more thoroughly protected, and hence is safer than the ordinary type of contact rail. There are no projecting live edges or bolts, and no slot between the third rail and its cover through which an animal or any person ignorant of danger can make contact with the live conductor. The only possibility of reaching the third rail is from below and by an upward movement, and this fact, it is thought, greatly decreases the chance of injury from shock. Other advantages which it is claimed are possessed by this arrangement over the ordinary type of third rail are: (1) There is less strain on the insulators, as the pressure from the shoe acts against instead of with gravity; (2) the board protection, having a continuous support, is less apt to crack and warp; (3) the rail is more protected from the weather, and hence less liable to corrode; (4) the contact surface is more thoroughly protected from sleet and snow; (5) the construction is self-cleaning, and as there is a much greater space between the lower portion of the third rail and the tie, there will be less danger of an accumulation of snow, ice and rubbish, and consequently less leakage.

The Increasing Use of the Fan Motor.

Although the uses of small motors are legion, scarcely a week goes by in which some new application is not made by progressive consumers of electricity. The fan motor is no exception, and the energetic efforts of central station and supply men long ago turned this convenient device to good account regardless of the season of the year. The use of the fan motor in keeping window panes clear from frost is now an old story, and the up-to-date photographer discovered not long ago that the process of drying plates can often be cut from several hours to twenty or thirty minutes by the use of the device as an evaporation accelerator. At the Cape Cod naval wireless telegraph station the Leyden jar chamber containing the spark-gap is fitted with a 65-volt fan motor which extracts the oxidized air from the apparatus to prevent excessive oxidation, and in the lecture tables of the most modern chemical laboratories found in educational institutions are installed gratings through which the fumes of chlorine and other irritating gases are drawn by fan motors at the other end of the connecting ducts. Autopsy tables are readily ventilated in the same general way. The Italian fruit dealer has now taken up the electric fan for out-of-door work, and with a few ribbon streamers attached it serves a most useful purpose in keeping flies, other insects and dust away from the fruit-stand, at a cost of probably not over $2 per month in the warmest weather.

Plotting Saturation Curves.

By Alexander Millar Gray.

Perhaps the most important data of any direct-current generator or motor reside in its no-load saturation curve. This curve is always taken experimentally in terms of field amperes and terminal volts, but by a little manipulation the utility of such a curve can be greatly increased.

In Fig. 1 are three curves taken from the same generator for speeds of 100, 160 and 200 rev. per min., respectively. As the

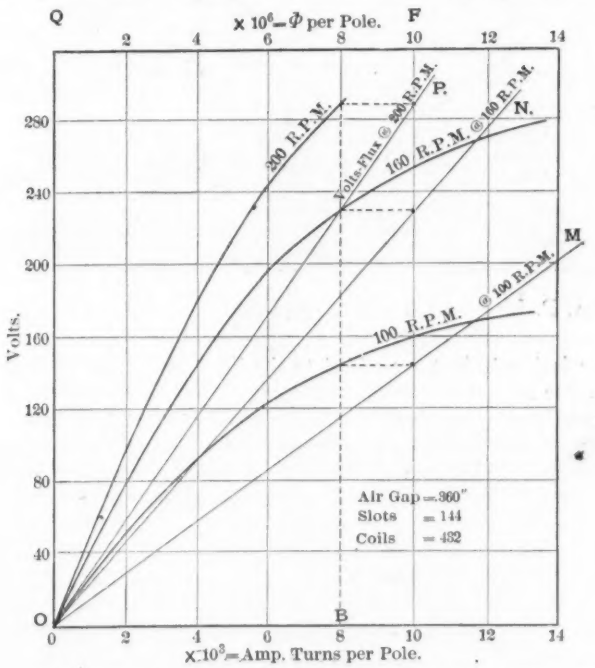


FIG. 1.—MAGNETIZATION CURVES OF A GENERATOR AT VARIOUS SPEEDS.

e.m.f. is a function of the speed, the curves are different at the different speeds; but, since the e.m.f. is proportional to the speed, the curves for different speeds can easily be interpolated, so that the saturation curve of the generator at any desired speed can be obtained at once.

Since the flux due to a certain field current does not depend upon the speed, it is possible to put the saturation curve in a form such that it is independent of the speed, as shown in Fig. 2. The method of transposition from the curves of Fig. 1 to the curve of Fig. 2 is very simple. Consider any number of ampere turns as *O B*. These turns create flux *Q F* (Fig. 2) which in turn causes the generation of a certain voltage corresponding to each speed.

The irregular curve of Fig. 2 is thus plotted for various values of field current and field flux. The straight lines, *O M*, *O N* and *O P*, are drawn in such a way that at the field current corresponding to *O B* giving the field flux *Q F* (Fig. 2) there will be generated the e.m.f. $O E_1$ at 100 rev. per min., $O E_2$ at 1,600 rev. per min., and

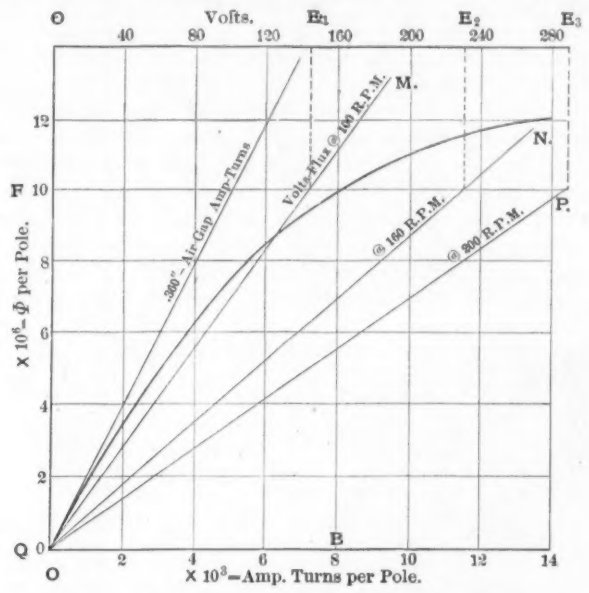


FIG. 2.—MAGNETIZATION CURVE FOR ALL SPEEDS.

$O E_3$ at 200 rev. per min. As seen in Fig. 2, these values are found at the intersecting points of the lines *O M*, *O N* and *O P* with the horizontal line through *F*. The method of using the curve is as follows: Selecting any certain field current on the bottom scale, pass vertically up to the irregular curve, then horizontally over to the required speed curve, then vertically up to the top scale where will be found the value of the e.m.f. generated at that speed and field current.

With the curve as it now stands, all that is necessary in order to find the field excitation at another speed is a new speed line; whereas in Fig. 1 a new saturation curve must be plotted by interpolation.

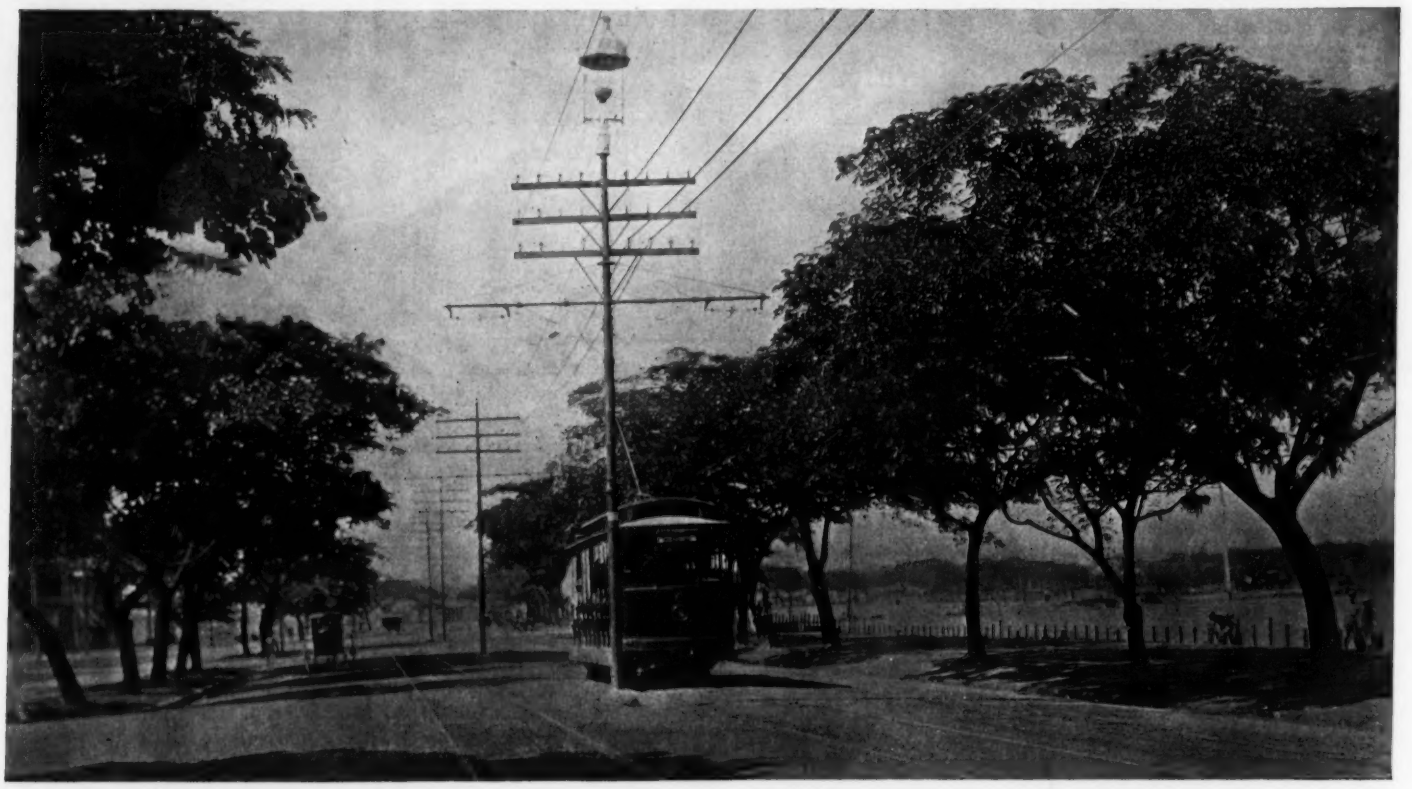
American Trolleys in Manila.

A long step forward in the Americanizing of the Philippines was celebrated recently at the official opening of the Manila Street Railway. The plant of the Manila Electric Railway & Light Company not only serves the purpose of supplying adequate transportation and lighting service to Manila, but it justifies the belief that it was possible to educate the ordinary Filipino technically, so that he could undertake skilled work as well as that of an ordinary laborer. Many Filipinos are now employed in the capacity of carpenters and machinists, as well as conductors and motormen on the cars, and do excellent work. During the past two and one-half years some 1,500 to 2,000 of the "little brown men" have been occupied in erecting the power house and car barns and installing a complete electric system. Their wages ranged from 50 to 70 cents per day, varying according to their occupation. The Filipinos were well satisfied with this small sum, because it was almost twice as much as they were accustomed to receive under Spanish rule. The main trouble was to keep them at work steadily. With their increased wages they felt that two or three days of consecutive labor were quite sufficient. By allowing them to observe innumerable feast days and letting them take a rest in the middle of the day when the heat was intense, experience has shown that the ordinary Filipinos may be rendered more willing to work.

A hard problem was to find a wood for ties and poles, and also for the car bodies, which would withstand the assault of the white ant and be practically weather-proof. As an experiment three kinds of wood were used for ties: the native wood called molave, California redwood, and an Australian wood. Further experimenting has been done by treating the ties with preservatives such as creosote, jodelite, solignum and carbolineum. The rails were painted

with asphaltum, and in low-lying ground were laid in concrete. The only wood which seemed to be ant-proof was teak, and the cars were built of this material, combined with steel of a heavy design, which was carefully protected with rust-proof paint. Teak is a dense, hard wood which needs no chemical treatment. It is difficult to work with tools and to steam bend, and has such a beautiful appearance that the cars were finished in the natural color wherever possible.

The Manila climate is intensely hot and hurricanes are of common occurrence. The majority of the equipment consists of open cars, but several convertible and semi-convertible cars are being used for experimental purposes. Absolute simplicity was the keynote of the designs for the cars, so that there would be no difficulty in keeping the cars clean. The heavy, driving storms occur so frequently that extra precautions were taken to secure the comfort of the passengers. All cars are vestibuled and equipped with curtains of Pantasote mounted on extra heavy slats which will resist the strongest wind. The gutters, water ducts and cables for curtains



TROLLEY LINE IN MANILA, P. I.

are made of non-rusting metals, and the dashboards of extra heavy steel. There is a considerable overhang to the monitor roofs and the ventilation is so arranged as to readily dispose of any water which may collect.

The Manila Electric Railway repair shops are thoroughly equipped to design and build their own cars, and are conducting experiments with a view to using native woods. The present equipment consists of 95 passenger cars furnished with Westinghouse two-motor equipment throughout. On account of the lower price of teakwood in Europe most of the car bodies were purchased there, but the trucks were purchased in America. The power house contains four Westinghouse turbo-generators which produce approximately 4,000 hp of electricity for general power purposes, and lighting is furnished by the company as well as the power for the street railroad. The power house, car barns and other buildings are erected entirely of steel and concrete, all exposed metal parts being covered with paint to guard against deterioration.

Viewed as a whole, or in detail, the plant of the Manila company, which was built and is being operated by J. G. White & Co., of New York, is fully up to the most advanced standard of American practice, and it is a matter of no small importance that our Filipino fellow-citizens should have in their capital city such an object lesson and training school in up-to-date mechanical and electrical engineering.

Illuminating Engineering and Central Stations.

BY JAMES R. CRAVATH.

WHEN those relics of the barbaric days of the central station business, flat rates and free wiring of customers' buildings, began to disappear there began a tendency on the part of central station companies to interest themselves only in the delivery of current at the customer's service switch without bothering as to whether the customer made efficient or inefficient use of the current taken for lighting. The central station man thought he had troubles enough of his own maintaining good service outside the building without attempting to advise customers as to methods of securing the best results from an illuminating standpoint. This tendency was unfortunate and many soon began to realize it. In every town the central station has one or more competitors. In the small towns it must compete with the kerosene lamp, the private gasoline or acetylene plant and the individual gasoline arc. In the larger towns gas and the isolated plant are added to the list. It is, therefore, of first importance to give customers of the central station the best illumination possible for a given amount of money. Furthermore, good lighting of one customer's premises forces others to increase and improve their lighting, and this in turn means increased revenue.

The average customer little realizes how easy it is to throw away a large amount of light, and many central station men have been so engrossed with problems of production and distribution that they have neglected illuminating engineering. To such the writer would suggest that between the boiler room and the customer's counter, desk or table there is usually no place where a little study can produce more marked improvements in efficiency than at the point where the light is utilized. The obvious moral is that the central station companies should pay more attention to illuminating engineering. In the small company, the manager, and in the large company, specialists in that branch of the business, should see to it that the frequent "horrible examples" of lighting that we have before us at the present day are not added to. Every influence should be brought to bear on new customers to have their lighting properly planned either by the company's expert or by some other competent engineer. In the small towns the planning of the lighting too often falls to some contractor who may be an excellent wireman, but knows little of illumination. In large cities in large buildings the lighting comes under the architect. The architect has neither the time nor opportunity to make a thorough study of illuminating engineering if he is to be

a master of the other branches of his profession and I think the lighting of the majority of large buildings bears sad testimony to this fact.

Nor is the electrical engineering profession entirely guiltless as regards poor lighting designs. The writer has known cases where the illuminating engineering of large buildings has come under the direct supervision of the electrical engineer who designed the electrical plant and system of distribution in the building, and where the results were nearly as woeful as if they had been left to an architect. But we should not criticise these things too harshly, because as a matter of fact it has only recently begun to be realized how important a part illuminating engineering plays in the electric lighting business. Five years ago the term illuminating engineer was not a recognized part of the vocabulary of the electric lighting business.

It has been the experience of the writer and of others who have given some attention to the business of illuminating engineering that most of the work that they are called upon to do in this line is in redesigning or altering of lighting arrangements already installed that some one has unwittingly made a botch of. The day is coming (although it is by no means at hand) when this will be avoided by having the lighting designed right in the first place when the house is built. In the smaller towns it largely rests with the central station companies to see that this is done. In the larger cities it lies mainly between the central station companies and the architects.

While the general principles of good illumination are easily mastered the practical application of these principles to the cases that arise in practice requires considerable exact and technical knowledge of what the various appliances on the market are and what they will accomplish. The ignorance of some men in the practical end of the central station business as to some of these things is astounding. It is time for them to wake up and find out what can and should be done with the product they are selling (light) to make it most effective. It is as the owner of a large hall once remarked to the writer after he had just been to the expense of a general overhauling of the lighting arrangement because of the inefficiency of the first plan tried. He said: "The ordinary man isn't supposed to know about this lighting business, but these electrical fellows ought to know enough to avoid such mistakes."

One thing that has always been in the way of good illuminating engineering is that lighting seems to the average person such a simple thing that it is hard to realize that skill, experience and technical knowledge are necessary to do a good job.

Most large central station companies have connected with their soliciting or contract departments an engineer who makes a specialty of power business, who is able to go to the owner of the private steam plant and figure intelligently with him in the light of previous experience, to determine the size and cost of motors needed, and, in fact, to do a considerable amount of free electrical engineering work for a customer in order to get him started as such. It is rare to find equally good illuminating engineers with a company, but such a condition is not going to exist always.

New Telephone Patents.

CIRCUIT SYSTEMS.

As is well known, the earliest central battery systems employed a retardation coil with battery in the middle, and the whole bridged to the circuit, as a means of introducing current into talking circuits. This was followed by the repeating coil, with the two parts, the calling and called, separated and a single battery feeding both sides. Since there has been developed the two-battery system with both repeating coil and single and double retardation coil feed. Mr. K. B. Miller now brings out a double-battery circuit with double retardation coil feed, but with the calling and called parties interconnected, in so far as concerns the talking circuits, through a repeating coil. The rudimentary circuit, practically self-explanatory, is shown in Fig. 1. Mr. Miller has assigned his patent to the Kellogg Switchboard & Supply Company.

A second patent, assigned to the Kellogg Company, is one granted to W. W. Dean, which relates to lamp signaling for multi-section switchboards. With such boards, of large ultimate capacity, it will be remembered that the lines are divided into group of approximately 5,000 each, and each group is given a complete multiple switchboard, with that group alone multipled, but with answering jacks for all four groups.

In making a call a subscriber must select his answering jack situated on the proper switchboard, he having of course one answering jack and line signal on each board.

Mr. Dean accomplishes the selection by means of four push buttons

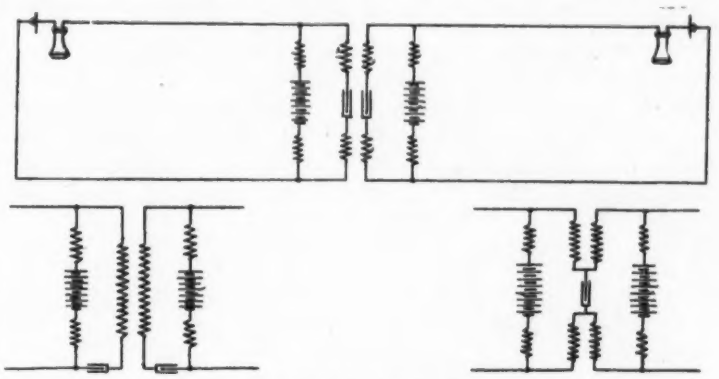


FIG. 1.—MILLER CIRCUIT SYSTEM.

and three relays. The combinations required are: Ground on one side of line, ground on the other side of line, equal ground on both sides, unequal ground on two sides. By using three relays signaling may be accomplished on relay associated with each side of line and one differentially associated with both sides. The operation of the differential and either of the line relays gives two selections. The operation of both line relays and failure of differential gives a third, while the operation of all three, i. e., where ground is unbalanced, gives the fourth combination.

COMBINED RINGER AND GENERATOR.

Fig. 2 shows in section a combined ringer and generator. When the generator armature is driven by the shaft, the home bell is rung

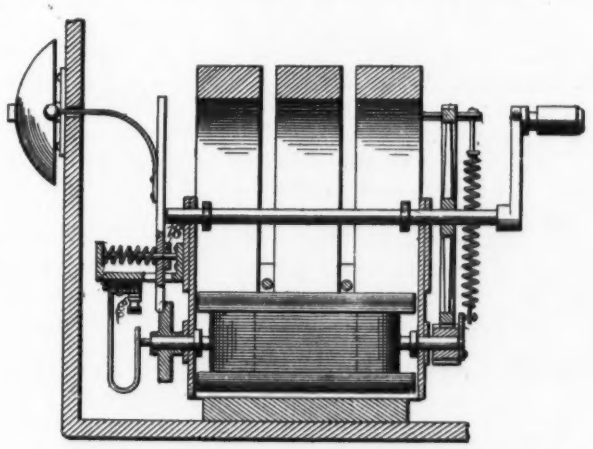


FIG. 2.—CAMPBELL COMBINED RINGER AND GENERATOR.

through a mechanical connection between the armature and striker. When ringing current comes in from a foreign station this oscillates the armature of the generator, and through the mechanical connection strikes the bell. This apparatus is the invention of T. R. Campbell, of Aberdeen, S. Dak.

ANTISEPTIC DEVICE.

To the long line of transmitter antiseptic devices another has been added by O. H. Savage, of New York City. This consists of a metallic cap piece carrying an antiseptic pad, which is so associated with the transmitter as to be adapted to close over it when out of use.

Searchlight on Pike's Peak.

A special dispatch August 29, from Colorado Springs, Colo., says: "To-night one of the greatest searchlights in the world will flash upon the west from the summit of Pike's Peak. Possessed of twice the power of the lights carried by great battleships, and built upon a track 120 ft. in circumference, with rotating contact, this marvelous light will fall upon the Kansas-Colorado State line, the Royal Gorge, Denver, and the Cripple Creek gold fields. The beacon may be observed 280 miles."

LETTER TO THE EDITORS.

Efficiency of Spark Coils.

To the Editors of Electrical World and Engineer:

SIRS:—I note with interest an editorial in the issue of August 12 entitled "A Field for Investigation" regarding the collection of data relating to the efficiency, etc., of spark coils. During the course of some work done for a thesis, I developed a method for the testing of spark coils and tested two coils of different make and design with the results noted below.

The work was very simple in principle and consisted in metering the watts and amperes primary input, and the secondary current and the watts developed in the spark. The watts input was measured with an ordinary low-reading Weston wattmeter, and the primary current with a hot-wire ammeter, adopted to give the effective value of the pulsating current. The value of the secondary current was determined by the use of the lamp bridge, described by Dr. Frederick Bedell in your issue of June 10, 1905, and which I developed for use in connection with this work. The heat development in the spark was measured by means of a calorimeter, which had previously been calibrated by means of a resistance coil inserted in it and warmed by the passage of a known direct-current, the rise of temperature for different expenditures of watts thus furnishing a basis for a calibration curve. It was assumed that all the energy not accounted for in the secondary copper loss and heat development at the spark was consumed in iron losess.

The coils tested were two in number; one built by Kohl for purely laboratory purposes and the other an Apple gas-engine coil designed for producing a hot spark rather than one of excessive length, as was the case with the German coil. The data of the tests are given below:

Coil tested.	Kohl.	Apple.
Primary input, watts	7.89	6.3
Primary copper loss, watts	1.3	.52
Primary copper loss, per cent	16.5	8.25
Secondary copper loss, watts	.49	1.3
Secondary copper loss, per cent	6.2	20.6
Developed in spark, watts	.9	1.08
Developed in spark, per cent. (efficiency)	11.4	17.2
Total iron loss, etc., watts	5.2	3.4
Total iron loss, etc., per cent	66.0	54.0

These results were obtained in tests in which the coil was in continuous operation and not under actual conditions of engine ignition, i. e., intermittent action, but I send them to you for what they are worth, trusting that they may be of some little value. It seems as if the large iron loss might be somewhat reduced by making the core of finer wire, although the increase in cost of manufacture might not be counterbalanced by the increase in efficiency.

WILKINSBURG, PA. C. A. CARPENTER.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Kinetic Variation of Pressure of Generators.—RUSSELL.—By the "drop in pressure" is meant the difference between the no-load and the full-load voltage when the machine is run at constant speed and constant excitation. While this value is of practical importance, it seems of greater importance to know how the voltage of a machine varies with its speed. The author refers to some recent investigations of Boucherot and Guéry. What one wants to know in practice is the percentage variation of the e.m.f. produced by an x per cent drop in the speed, or in other words, what is the ratio of the percentage variation of the e.m.f. to the percentage variation of the speed. This ratio in self-excited machines is called the kinetic factor of the e.m.f. for an infinitely small percentage variation of speed. The author shows how to determine the kinetic factor from the characteristic curve which shows how the e.m.f. generated varies with the excitation. The author first determines the kinetic factor of a series dynamo. In Fig. 1 OP is the total characteristic of the machine

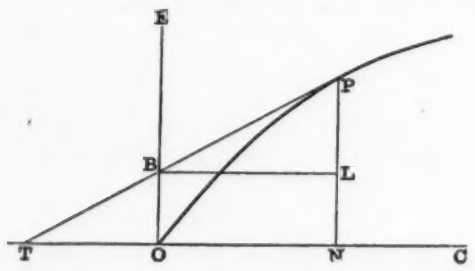


FIG. 1.—TOTAL CHARACTERISTIC OF SERIES-WOUND DYNAMO.

when the armature rotates with a constant angular velocity. The ordinate, PN, represents the total e.m.f., and the abscissæ, ON, represents the current around the circuit. In this case the kinetic factor equals the ratio of TN to TO. It is to be noted that its value depends only on the strength of the current round the circuit, and consequently only on the strength of the magnetic field. The kinetic stability of the machine depends, therefore, on the strength of the magnetic field. For weak fields the kinetic factor is large and for strong fields it approaches the value unity. The author then discusses the case of a shunt dynamo and shows that the greater the value of the current in the shunt windings, the greater the value of the kinetic factor, and, therefore, the greater the stability of the running. As to the best value of the kinetic factor, it is said that if expense were no object the kinetic factor could be made equal to 1.1 for instance, by designing the machine so that the iron in the magnetic circuit was subjected to very high magnetizing forces at the normal load. In practice, however, a machine with a kinetic factor which is not greater than 2 at the normal load is found to satisfy all reasonable requirements. The author finally discusses the kinetic factor of an alternator with the exciter geared to the shaft.—Lond. *Elec.*, August 4.

Polyphase Rotors.—PUMPHREY.—Some notes on the winding of polyphase rotors. The author gives data collected from the leading English makers showing an enormous discrepancy in the secondary voltage in the rotor (between slip rings) in machines of the same size and the same primary voltage, but made by different manufacturers. This shows that it would be very difficult to standardize three-phase starting and controlling gears. Cases frequently arise where two motors of similar horse-power and connected on the same circuit, but of different makes, have rotor currents in the ratio of two to one. The cross-section of the copper required in one set of controlling gear is thus double that of the other, the resistances are of widely different design, and the prices also differ considerably. From the point of view of cheapness of starting and controlling gear, it is certainly advisable to work with low secondary currents and moderately high voltages. "Where female labor can be employed for rotor winding, it is essential to use thin wire, for obvious reasons, and practice shows that it is cheaper to wind thin wires in series than in parallel. This, of course, necessitates high voltages. On the other hand, where male labor is employed, it is usually less expensive to wind with thick wire or copper strip, and designers, as a result, prefer to employ large currents in the rotor, and correspondingly low voltages." Moreover, if the voltage is kept low, the insulation question becomes of less importance, and additional saving can be made in this direction.—Lond. *Elec. Rev.*, July 14.

Alternator.—REYVAL.—An illustrated article describing a steam-driven generating set exhibited at the Universal Exhibition in Liege. The generator is built by the Alioth Company and gives 235 kilovolt-amp. at 3,000 volts with a frequency of 50 periods per second, when running at a speed of 500 r.p.m. It is of the revolving-field type and has 12 poles. The construction is described and illustrated in detail, and the dimensions are given in a table.—*L'Eclairage Elec.*, August 12.

Alternators.—PREUSS.—An article, illustrated by diagrams, on a method of determining the stray flux of the exciting field of alternators.—*Elek. u. Poly. Rundschau*, August 1.

Testing Alternators.—REMAR.—An article giving hints on the testing of alternators.—*Elek. Anz.*, July 30, August 3 and 6.

Dynamos with Commutation Poles.—ROTTH.—Some notes on observations which the author made with a machine provided with commutation poles, and which he considers to be not in accordance with the usual theory. Further investigations are suggested.—*Zeit. f. Elek* (Vienna), August 6.

LIGHTS AND LIGHTING.

Street Lighting in London.—Some notes on a decision of the corporation of the City of London to replace about 1/10th of its public arc lamps by incandescent gas lamps. The installation of the latter is only an experiment, but the experiment is to be performed under considerations distinctly unfavorable to the case of electric lighting. While the most modern system of incandescent gas lighting is to be installed the electric company is not given an opportunity to replace the arc lamps put in about 14 years ago.—Lond. *Elec.*, August 4.

POWER.

Single-Phase Cranes.—PERLEWITZ.—An illustrated article on single-phase cranes used in the Cologne-Dentz harbor. The mechanical equipment is described in great detail. The motors are single-phase machines of the Winter-Eichberg type. Each crane is provided with three motors, one of 40 hp and two of 10 hp each. The voltage is 500 and the frequency 50. The current is supplied from a transformer station which is directly connected to the 2,100-volt, single-phase supply system of the city. The motors are controlled by means of transformers by regulating the voltage at their terminals.—*Elek. Zeit.*, August 10.

Shunt Motors for Electric Cranes.—HILL.—An explanation of the advantages which the shunt motor offers for driving the hoisting gears of cranes, more especially when these gears are remote from the controller. The complete equipment for a shunt motor hoisting gear consists of the motor itself, a plain on-and-off electromagnetic brake, a drum controller and a shunt regulating switch placed conveniently. A circuit-breaker is also advisable. With this arrangement the controller is so designed that, on the first step, the motor-magnet is always fully excited, irrespective of the position of the shunt regulator, so that on this step a speed as slow as desired is obtained. The controller has contacts corresponding to and connected with the contacts on the shunt regulating switch. As it is moved over it cuts into the magnet circuit the amount of resistance determined by the position of the shunt regulating switch, so that when the controller is full on the speed of the motor corresponds to the position of this switch. When lowering, the shunt motor shows specially to advantage, as, when overhauled by the load, it commences to produce current, and the current so produced not only opposes a torque to the motion of the load sufficient to keep its speed within the limit set by the regulating switch (so saving wear of brakes), but it also feeds the circuit, and so helps to drive other machines. Some diagrams are given.—Lond. *Elec. Rev.*, July 14.

Lifting Electromagnets.—SCHIEMANN.—An article in which the author considers the action of lifting electromagnets by applying the principle of the conservation of energy. He develops the following formula: The mechanical work of electromagnets equals one-half the ampere-turns multiplied by the variation of the magnetic flux due to the movement of the armature. Or, in other words, if the magnetic flux of an electromagnetic system of constant magneto-motive force varies, it performs mechanical work equal to one-half the product of the number of ampere-turns and the change of the flux.—*Zeit. f. Elek.* (Vienna), August 13.

Oil Fuel for Power Plants.—A continuation of the serial on the economy of steam power plants using oil fuel. Tables are given for the approximate cost of power at the switchboard per kw-hour for office building plants. It is estimated that a plant having two 50-kw units will develop power, based on oil at 75 cents per barrel, at a rate in the neighborhood of 3 cents per kw-hour, or less, depending on the load factor. A plant of 400 kw capacity at the same fuel rates will develop power at a net cost from 1.6 to 2.6 cents per kw-hour, depending on the load factor, etc.—*Jour. of Elec., Power and Gas*, July.

Tunnel Construction.—HERZOG.—A fully-illustrated article on the construction of the Karavanken Tunnel in Austria. Electric power is being used for many purposes of the construction, and the authorities contemplate in future electric operation of the Karavanken Railroad.—*Elek. Bahnen*, June 24, July 4 and 14.

Electric Winding Machines.—HABETS.—The first part of an illustrated reprint of his paper which was abstracted recently in the Digest.—Lond. *Elec.*, August 11.

Gas Engines.—MATHOT.—A paper on the increasing use of large gas engines in Continental Europe.—Lond. *Elec.*, August 11.

Power Plant.—KNOWLTON.—An illustrated article on the power plant of the United Shoe Machinery Company, at Beverly, Mass. The electric generating equipment consists of two Curtis steam turbines, each direct-connected to a four-pole, 600-volt, three-phase, 60-cycle, 500-kw alternator.—*Eng'ing Record*, August 19.

French Power Transmission.—An illustrated description of the transmission plant of the Société d'Energie Electrique du Littoral Mediterranean, destined to supply power to Toulon. A voltage of 28,000 will be employed, which "is a big advance on anything of this nature previously attempted in France." The generating plant includes three sets each composed of a 1,000-hp turbine direct-coupled to a 700-kw, three-phase alternator.—Lond. *Elec. Rev.*, July 21.

Innsbruck.—The first part of a fully-illustrated description of the hydraulic equipment of the Sill power plant utilizing the waterfalls of the Sill River for the generation of electrical energy for lighting and power purposes in Innsbruck, and for the operation of the Stubaital Railway.—*Elek. Bahnen*, June 14.

TRACTION.

Single-Phase Traction in Belgium.—DIETL.—A fully-illustrated article on single-phase traction in the Borinage district, which is the Southern coal region of Belgium. The railways in this district are owned, like all interurban roads in Belgium, by the Société Nationale des Chemins de Fer Vicinaux, which operates at present roads with more than 1,300 miles of track. This company was one of the first to introduce electric traction in Europe, but it could do so only on five of its lines, which in their character resembled street railways. All other lines were operated by steam, although the company always intended to introduce electric traction. When direct current at 600 volts was found to be uneconomical the company asked for bids for a three-phase system, but the tenders did not fulfill the expectations. It then concluded in March, 1903, to use the single-phase system, and this would have been the first commercial line of this system in Europe if there had not been delays in acquiring some land needed. The total length now equipped with the single-phase system is 12 miles, but this will be extended to 77 miles, which will be supplied from one point with single-phase current at 6,600 volts. For the lines equipped at present the voltage is reduced in transformers along the line to 600 volts, while for further extensions a higher voltage will be employed on the trolley wire in order to reduce the number of transformers needed. The company does not own a power plant, but buys the power from a lighting and power company. The frequency is 40 periods per second. The equipment of this power plant is described in detail. It contains only three-phase generators and for traction two phases only of the generators are used. The arrangement is illustrated in diagrams. There will be four transformer stations, operating in parallel on the network. Since there are telephone lines in the neighborhood which use the earth as return, the rails could not be used for the return traction current; there are, therefore, two overhead trolley wires. The motors are of the Winter-Eichberg type. Each motor car contains two 40-hp motors. The characteristic curves are not as good for a frequency of 40 as for a frequency of 25, but are said to fulfill all the requirements of the service. Regulation is obtained by series-parallel control in connection with a regulating transformer; the connections of the stator winding (only) are changed, while the rotor windings are always connected in series. The regulating transformer is built as an autotransformer. There are no resistances used for starting, but a resistance is employed for the change-over from the series to the parallel connection. The system has been in operation since April 6, and has proven perfectly satisfactory.—*Elek. Bahnen*, June 3; more briefly in *Zeit. f. Elek.* (Vienna), August 13.

Ward Leonard System for Traction in Switzerland.—An account of experiments made by the Oerlikon Company with the Ward Leonard system. Some of the results of the experiments have now been made public. The locomotive weighs complete about 44 tons, and it has been employed during the trials for hauling trains varying in weight from 125 to 255 tons. In connection with a 200-ton train (excluding the weight of the locomotive) a speed of 18 miles

per hour on an 0.8 per cent grade is said to have been obtained; the power of the locomotive, measured at the rim of the driving wheels, being approximately 200 kw. During the run mentioned the power supplied to the low-pressure terminals of the step-up transformers at the power house averaged 300 kw. On level track this train accelerated to a speed of 18½ miles per hour in 57 seconds, the motors running sparklessly all the time. It is stated that the electric braking is so simple and efficient that it is always used in preference to braking with the compressed air outfit. The following data refer to a particular run on an 0.8 per cent grade, the locomotive hauling a 200-ton train: Line voltage, 15,000; speed, 16.8 miles per hour; average supply from the power house, 310 kw; average power at the rim of the driving wheels, 216 kw; total efficiency, 69.5 per cent. It is computed that the individual efficiencies are as follows: Motors and gearing, 86 per cent; motor-generator, 85 per cent; locomotive step-down transformer, 98.5 per cent; the exciter and air pump consumed 2 per cent of the total energy, and the losses in the overhead line amounted to 0.5 per cent. The watt-hours per ton mile came to 68.2 on the grade, and 23.7 on the level.—Lond. *Elec.*, August 4.

Interurban Railway in California.—A fully-illustrated description of the San Jose & Los Gatos Interurban Railway. The electric current is supplied from sub-stations which are fed from the large California power companies.—*Jour. of Elec., Power and Gas*, July.

Calcutta.—An illustrated description of the Calcutta electric tramways, which cover a total length of 23 miles of double track. This system is the largest and most important of the tramway systems of the East.—Lond. *Elec. Rev.*, July 14.

Underground Distribution of Power for Traction.—HEYWOOD.—An illustrated discussion of the requirements of feeders, ducts and conduits for underground power distribution for urban electric traction.—*St. R'y Jour.*, August 19.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Central Station Transformer Testing—Insulation Tests.—NESBIT.—An article illustrated by diagrams on the tests for finding the copper loss, the regulation and ratio, the iron loss, the temperature variation and the insulation of transformers. Complete insulation tests consist of insulation resistance, over-potential and puncture tests. For making all insulation tests it is desirable to have a portable testing transformer wound to give various voltages between 100 and 15,000 volts. In the absence of a regular testing transformer six or nine ordinary lighting transformers thoroughly insulated from each other and connected in series, as shown in Fig. 2,

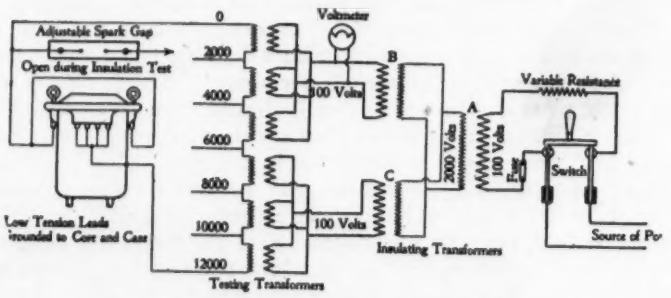


FIG. 2.—CONNECTIONS FOR INSULATION TEST.

may be used. The transformers *A*, *B* and *C* shown in this sketch are used simply to insulate the high-voltage circuit from the source of power and to limit the strain to which the insulation of the six testing transformers are subjected (by reason of their high-tension windings being all connected in series) to 6,000 volts. These three transformers may be dispensed with and the high-tension windings of the remaining six connected in series. Grounding the middle point of this series will relieve it of excessive strains. If this ground connection is made it will be necessary to thoroughly insulate all the transformers, including the transformer being tested, from the ground. Before proceeding with the insulation test it is desirable to insert an adjustable spark-gap between the 10,000-volt leads of the testing transformers so as to make certain that the voltage strain from the testing transformers does not exceed that produced by 10,000 volts. If the voltage has a sine wave form 5,000 volts will jump through dry air between sharp needle points at a distance of 0.225 in.; for 10,000 volts this distance is 0.470 in., 15,000 volts 0.700 in., 20,000 volts 1.000 in., 25,000 volts 1.300 in., 30,000 volts 1.625 in. If the voltage has a peaked curve a given voltage will jump a greater distance. With a 10,000-volt circuit the procedure is as follows: Space the needle points on the spark-gap 0.47 in. apart, connect the spark-gap across the 10,000-volt circuit and insert all of the variable resistance in the primary circuit; now throw in the line switch and gradually cut out the variable resistance until the current jumps across the gaps, and note at what deflection on the voltmeter this jumping occurs. This will be the deflection to use in making tests on transformers for a 10,000-volt strain. The actual voltage may vary above or below 10,000 volts according to the form of the wave, but the transformer will receive a strain equivalent to that of a 10,000-volt sine wave. In making this test both high-tension leads of the transformer under test should be connected together and to one of the 10,000-volt leads. Connect all the low-tension leads together and to the other 10,000-volt lead with the low-tension leads also connected to the core and the case. Disconnect the spark-gap, throw in all the variable resistance, throw in the line switch and cut out the variable resistance until the voltmeter indicates the same deflection as was indicated when the spark-gap was ruptured. Hold the voltage at this point for about five seconds, then cut in the variable resistance and open the line switch. The insulation between the low-tension winding and the core may be tested in a similar manner by setting the spark-gap for the required voltage and changing the connection to the testing transformers. If there is a considerable discrepancy between the spark-gap method of determining the voltage and the voltmeter reading multiplied by its ratio of transformation, investigation should be made at once. Some notes are added on the calculation of the efficiency of transformers.—*Elec. Jour.*, August.

British Gas-Driven Stations.—Reports on last year's accounts of the stations of Ryde and Walthamstow, both of which are gas-driven. The Ryde station sold during the last year 78,505 kw-hours. The total work cost was 6.04 cents per kw-hour sold; the cost, including management charges, was 10.04 cents. The capital expenditure was as high as $1,105.55 per kw. The load factor was 10.5 per cent. At Walthamstow the results were as follows, the figures in parenthesis giving the results for the year before last for comparison: The number of kw-hours sold was 1,062,446 (840,187). The total works cost was 2.72 cents (2.74) per kw-hour; the total cost, excluding capital charges, 3.28 cents (3.52), the total cost, including interest, repayment of loan 6.12 cents (6.78). The capital expenditure was $386.20 ($694.30) per kw. In an editorial note it is pointed out that this is not a favorable showing for gas-driven plants. "However suitable gas engines may be for driving small isolated electric light plants, they cannot compare with steam engines for small public supply stations." It is said that "undoubtedly far better results would be obtained from larger stations with units of larger size, but figures are still lacking to show whether the large gas engine will prove in the end more economical than the large steam turbine or the reciprocating engine." The high overload which the steam turbine can carry with economy is also greatly in its favor as compared with the gas engine, for it represents spare plant capacity in a factory of large size.—Lond. *Elec.*, July 28.

Berlin Electricity Works.—An abstract of the annual report of the Berlin Electricity Works from July 1, 1903, to June 30, 1904. A dividend of 9½ per cent is to be paid. By reducing the price of electric light numerous new consumers have been obtained and large consumers have been induced to quit generating current themselves. The following table shows the development, the figures representing kw-hours sold:

	1894-5.	1902-3.	1903-4.
Private lighting	5,916,970	14,514,303	16,727,266
Public lighting	359,200	1,817,876	2,016,797
Power purposes	1,070,926	24,728,948	30,326,974
Storage battery plants	....	2,361,021	3,245,878
Street railways	....	41,425,300	45,166,449
Consumption for the purposes of the company	119,028	921,231	1,018,040
Total	7,466,124	85,768,679	98,501,404

It will be seen that the consumption of current for power purposes and traction is considerably greater than for lighting purposes. —*Elek. Bahnen*, June 3.

Dublin.—Some notes on recent extensions of the Dublin electric station which up to the present contained four three-phase, 5,000-volt generators, two having an output of 1,000 kw each and two of 500 kw. Recently an additional 1,500-kw set has been installed. —Lond. *Elec.*, Aug. 4.

Motor Load Factor and Station Load Factor.—TAYLOR.—A communication referring to the differences in practice in giving discounts. Some allow discounts in direct proportion to the load factor of the individual consumer's motor, thus in great measure neglecting the station load factor, while on the other hand the Dundee system of charging practically bases everything on the station load factor. The author formulates some ideal cases to show that both methods are wrong. Both motor load factor and station load factor must be used with judgment, the one to determine charges outside the station and the other those inside it. In actual practice the station load factor diminishes with a decreasing motor factor even though the motor connections be increased in the inverse ratio.—Lond. *Elec.*, July 14.

Induction Motor as Generator.—BUTT.—A paper describing the use of a dismantled induction motor as a generator during hours of peak load in Johannesburg.—Lond. *Elec. Eng.*, July 21.

ELECTROPHYSICS AND MAGNETISM.

Evolution of Hydrogen from the Cathode.—SKINNER.—In a study of the cathode fall of various metals, in helium he found a continual evolution of hydrogen; the source of the same was located in the cathode, and he found that the quantity of hydrogen evolved by a fresh cathode obeys Faraday's law for electrolytes, and that a fresh anode absorbs hydrogen according to the same law. Sixteen different kinds of metals were tested as cathodes, and all except two were found to give off hydrogen at a measurable rate. It was found that the metal recovers a supply of hydrogen by diffusion from within. With fresh electrodes the hydrogen atom serves in all cases as carrier of the electric current from cathode to gas. With a gas filling of hydrogen, the atom serves also as carrier from the gas to the anode, by which it is absorbed. In helium on the other hand the hydrogen atom leaving the cathode discharges to the helium and this transmits the current to the anode, the negative helium ion discharging without being absorbed. Most remarkable of all is the fact that, though there is a considerable concentration of free positive ions at the cathode surface, they do not discharge to the metal so long as it furnishes hydrogen sufficient to carry the current. This condition may last several minutes. Even the positive hydrogen ion does not enter into electrical union with the metal, though a negatively charged hydrogen atom is readily absorbed by it.—*Phys. Rev.*, July.

Hysteresis Loss.—HERRMAN.—In 1896 Grau and Hiecke made experiments from which they concluded that the hysteresis loss in iron in a revolving field is about double that in a single-phase alternating field. The present author has repeated and modified these experiments and shows that this conclusion is not correct. It is impossible to detect any essential difference between the two kinds of magnetization.—*Elek. Zeit.*, August 10.

Magnetic Rotation.—WOOD AND SPRINGSTEIN.—An account of an experimental investigation of the magnetic rotation of sodium vapor. —*Phys. Rev.*, July.

Color in Platinum Films.—ISABELLE STONE.—An account of experiments on the production of color rings by cathode discharges, using a platinum point as cathode.—*Phys. Rev.*, July.

Radioactive Substances.—Illustrated notes on the methods of testing radioactive substances.—*Zeit. f. Beleucht*, July 30, August 10.

ELECTROCHEMISTRY AND BATTERIES.

Electric Furnace for Making Steel.—HARBORD.—A discussion of the large field which exists for the electric furnace in England. He refers to the large quantities of Swedish pig iron imported to England for use in open-hearth furnaces for the manufacture of special qualities of high-class steel for large forgings, axles, etc. Another important branch is the production of dynamo steel of exceptional purity and low hysteresis, and in this direction the electric furnace promises great things, since steel of the greatest purity, low in carbon and manganese, can readily be produced. "If we add to these the manufacture of all kinds of ordnance, armor plate, projectiles, rifle, bayonet and other high-class steel, we see that without attempting to compete with Bessemer or ordinary open-hearth structural steel there is an immense field open to the electric furnace." The author discusses the various types of electric steel furnaces, and thinks that "from a practical engineering and metallurgical standpoint there can be no doubt that the Heroult furnace is far better designed to meet the general requirements of the steel manufacturer than either the Stassano or Kjellin furnace." "That steel made in the electric furnace should possess superior properties to steel of similar composition produced either in a Swedish Bessemer converter or in an open-hearth steel furnace may seem at first to be claiming a great deal, but such appears to be undoubtedly the fact, and this is due probably to its production in what may be regarded as a practically neutral atmosphere under conditions in which the occlusion of gases and overoxidation are reduced to a minimum."—From Eng'ing Supplement of Lond. *Times; Iron Age*, Aug. 24.

Electricity in Water Works.—GERARD.—A long illustrated paper on the use of electric power in connection with the water works of Breda, Netherlands. Alternating current is taken from the lighting network which is operated on the three-wire system with 200 volts between the outers. In the water works electricity is used for the operation of the pumps and for the production of ozone for the sterilization of the water. Ozone is produced by means of silent discharges at 65,000 volts. One kw-hour is stated to give 7 grams of ozone. The cost of the filtration and sterilization of water is stated to be one cent per cubic meter, of which amount 0.234 cent is due to the ozone treatment. Twenty cubic meters of water are purified per hour.—*Bull. Mens. Soc. Belge d'Elec.*, August.

Aluminum Rectifier.—PETERS AND LONGE.—A preliminary account of experiments on the influence of the nature of the electrolyte on the efficiency of the aluminum rectifier.—*Elec. Zeit.*, August 10.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring Small Resistances.—HAUSRATH.—A description of differential method for measuring small resistances. It is a modification of the differential method of Kohlrausch. The small resistances required in the latter are rendered superfluous by using a measuring wire with sliding contacts. As shown in Fig. 3, the measuring wire is formed by two parallel wires, and the condition $w'' = w'''$ is practically fulfilled by connecting the two sliding contacts with each other by means of an insulating material. A three-pole switch permits of connecting the source of current alternately with the higher or lower wire. The calculation requires the equality of the resistances w_1 and w_2. If an unknown resistance x is inserted, and the sliding contacts are so adjusted that the galvanometer shows no deflection, then $x = w'$ multiplied by a constant. The relation becomes especially simple if the measuring wire has a resistance of one ohm, and a shunt set of 1-9, 1-99, 1-999 ohm is used. The author describes and illustrates a shunt which is stated to be specially useful for his purpose. The method is especially suitable for testing conducting materials if the conductivity is to be found in percents of the conductivity of pure copper.—*Elek. Zeit.*, July 27; from *Ann. d. Phys.*, Vol. xvi, 1905, p. 134.

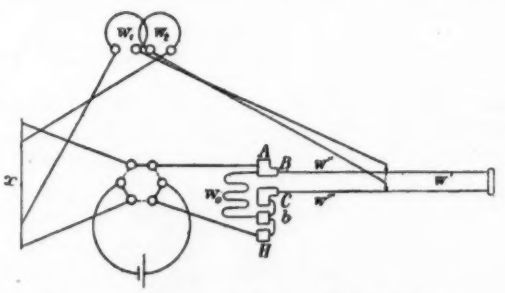


FIG. 3.—MEASURING SMALL RESISTANCES.

Measurement of Current by a Quadrant Electrometer.—STEWARD.—An abstract of a Physical Society paper on the methods in which a current flowing into a conductor connected to one pair of quadrants is measured by determining the velocity of the needle. This is the usual method in radioactivity work. Two cases are considered: First, that where the change in capacity of the electrometer due to the motion of the needle does not appreciably affect the capacity of the apparatus, and second, the more general case, where the capacity is treated as a variable.—*Phys. Rev.*, July.

Polarization of Standard Cells.—RAMSAY.—An abstract of a Physical Society paper on experiments made to determine the character of polarization of cadmium cells containing mercurous sulphate when connected to a battery.—*Phys. Rev.*, July.

Alternating-Current Laboratory Testing.—ROWE.—A continuation of his serial, illustrated by diagrams. In the present instalment he

discusses synchronous motors.—*Jour. of Electricity, Power and Gas,* July.

Telegraphy, Telephony and Signals.

Wireless Telegraphy in Great Britain.—An article giving statistical data on the condition of wireless telegraphy in Great Britain for the first three months of 1905. Data are given on the number of messages transmitted, and it appears that the public has not availed itself to any great extent of the privilege of telegraphing to ships at sea, although the passengers on these ships have sent many communications to their friends on shore. During three months only 111 outgoing messages were handled, and of these no less than 21 failed to reach their destination. The number of incoming messages was 1,655. The total revenue to the Marconi Company from wireless telegrams to and from ships is estimated as $2,220 for three months, which is a small amount in view of the heavy establishment charges. Information is also given on the applications which have been made for wireless telegraph licenses under the British wireless telegraph act. Only 10 out of 73 applications are for commercial work or private business purposes. Some progress has been made in the case of applications from the two American companies—the DeForest Company and the National Electrical Signalling Co. (Fessenden system). The latter company has been granted a site at Machrihanish Bay (about 10 miles north of the Mull of Kintyre on the west coast of Scotland), and the DeForest Company has been offered the choice of the Hebrides and the west coast of Scotland (presumably at some distance from the Fessenden station). Both of these licenses are considered to be for "experimental" purposes, in the first instance at any rate. In summing up it is said that the most important application of wireless telegraphy continues to be for naval and military purposes and for signalling to and from ships at sea.—Lond. *Elec.,* July 28.

Automatic Intercommunicating Telephone.

The accompanying illustration shows a type of intercommunicating telephone whereby it is possible to call with the receiver either on or off the hook, and also to communicate with several stations

FIG. 1.—INTERCOMMUNICATING DESK TELEPHONE.

simultaneously by pushing in two or more of the buttons at the same time. It is obvious that the set can be used to serve as a fire alarm by pushing all the buttons simultaneously and giving one long ring or other prearranged danger signal. One of the features of this apparatus is that buttons are restored automatically upon hanging up the receiver. The mechanism for talking and ringing has two positive rubber contacts; all the springs of the apparatus are made of phospher bronze and the buttons of hard rubber. The communications are soldered and insulated with mica, and the insulation of the springs is of hard rubber. The circuit wiring is tin covered and has a double insulation, one of cotton and one of silk. The apparatus, which can be arranged to connect with long-distance systems, is particularly applicable for intercommunicating services for school, flat and apartment-house systems. This instrument is made by the De Veau Telephone Manufacturing Company, New York.

Electric Traction Equipment for West Shore Railroad.

Another step in the electrification of leading railroad systems has been taken in the award of contracts for the equipment of the West Shore Railroad from Utica to Syracuse, N. Y. These contracts have been placed with the General Electric Company for motor equipments and sub-station apparatus, including four sub-stations, each to have four 300-kw rotary converters. The engineers are still undecided between third rail and a side-contact system. An overhead trolley was considered undesirable because of the gases arising from steam locomotives, and because of the danger to trainmen on tops of freight cars. The line voltage will be made to conform with that of the Utica & Mohawk Valley, with which the Syracuse-Utica line will be connected. The West Shore between these points is being four-tracked, and two tracks will be equipped for electricity. The West Shore through passenger trains between these points will be diverted to the New York Central tracks; in fact, this is being done very largely at the present time. Freight trains will continue to operate as heretofore.

To fill the gap between Syracuse and Rochester, the Andrews syndicate has acquired the Rochester & Eastern Railway, operating from Rochester to Geneva, 50 miles. The 50 miles from Geneva to Syracuse will be filled either by electrifying that portion of the Auburn branch or building a separate line. Between Rochester and Buffalo the syndicate has no plans that it cares to speak of at present, but the West Shore tracks could be utilized. As outlined this gives a continuous line from Rochester to Little Falls, a distance of about 160 miles, the plan for operation of which has been fully determined upon. The syndicate owns the Schenectady Railway, operating a 14-mile line from Schenectady to Albany, with other lines to Troy and Ballston Spa. From Schenectady westward to Tribes Hill, 22 miles, is the fine double-track line of the Fonda, Johnstown & Gloversville Railway. It is denied that this system

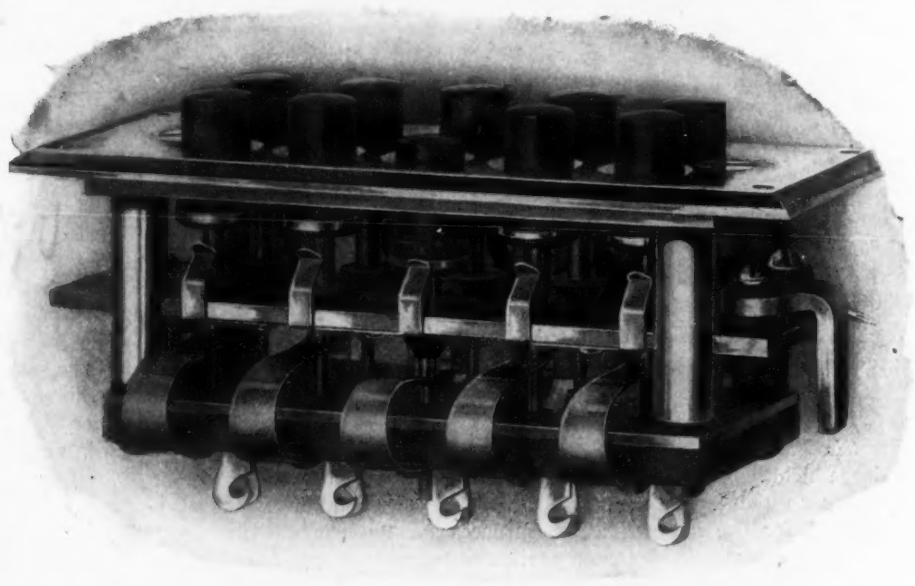


FIG. 2.—SWITCH MECHANISM.

has been acquired up to the present time. From Tribes Hill to Little Falls, 35 miles, there is no line at present. For current the Utica & Mohawk Valley leases from the Trenton Falls water power. This service will be abandoned as soon as the 33,000-volt transmission lines from the plants of the Hudson River Power Company, near Lake George, and which are now supplying the Schenectady system, are extended westward to Syracuse, giving a transmission line of about 126 miles. From Syracuse westward the power will be supplied from Niagara Falls, a contract having recently been made with the Ontario Power Company.

The Manufacture of Electric Automobiles.

In some electrical quarters, even those which are likely to consider themselves well informed, there has been prevalent an idea that the electric automobile industry has latterly been in a quiet if not declining condition. As a matter of fact, this is, however, very far from the truth, and it may be doubted whether at any time in recent years this branch of electrical manufacture has been in a more healthy condition than it is to-day. There is no boom, it is true, as there once was, but on the other hand the output appears to be increasing steadily, the demand is improving, prices have a more direct relationship to the rules of demand and supply, and for all purposes save those of a long tour the electric automobile appears to be better able than ever to hold its own. This is particularly true with relation to city commercial and industrial service, and to-day one has but to use one's eyes to note the large and increasing number of electric automobiles of all classes that are circulating the streets, rapidly if of the delivery type and more slowly if of the heavy dray variety, but all doing their work successfully and economically. Moreover, aside from such vehicles, there is a large and growing number of private automobiles replacing vehicles of the horse-drawn type, and in such cities as New York the electric hansoms and broughams certainly show no signs of diminution, but are in the briskest service at all seasons. It is believed, also, that the electric stage or omnibus in some form or another still has its day to come and will soon be in general application.

FIG. 1.—VIEW IN MAIN AISLE.

Pertinent application to these remarks may be given by the statement that the Vehicle Equipment Company, of Long Island City, which did not get down to business until about four years ago, has since then built, equipped and put in operation some 800 electric automobiles for 300 different concerns, nearly all of these machines being for industrial purposes, and the great majority of them continuing in operation down to the present moment. Such a record as this should give food for reflection, and be encouraging and stimulating to central station managers who see in the supply of current to such vehicles a large possible field which only needs cultivation and development. Up to the present moment the support given to the electric automobile by central stations has not been particularly marked, but with the lower price of current the vehicle comes most directly within practical range, and local companies everywhere are beginning to give attention to a subject which long ago should have received consideration at their hands. Obviously an enormous business offers here for central station people, supply men and the electrical industries in general, and a few calculations which any one can make would readily show how vast is the market thus to be opened up. It is well known that the cost of storage battery renewal has been the standard and stock argument standing in the way of the more rapid development of the electric wagon business, but to-day there is a mass of data available from which, we do not hesitate to say, it can be easily demonstrated that trackless transportation for freight, material, express, etc., can be more economically developed with storage batteries than with gasoline engines, and that for most of the utilitarian purposes in the city the battery wagon is far superior to its gasoline competitors. There is doubtless an excellent field for gasoline wagons, but it is undeniably true that the scope is small compared with that for electric commercial automobiles in all our great cities.

The Vehicle Equipment Company was organized about January 1, 1901. During the first year it built about fifteen wagons. Since that time the business has steadily grown until this year it is delivering on an average one wagon per day, while the indications are that the increase of business will develop at a greater rate than this. The company began its operations in one corner of a car barn belonging to the Brooklyn Heights Railroad Company, at Thirteenth Avenue and Thirty-seventh Street, Brooklyn, and gradually annexed the entire property. About a year ago, July 5, 1904, the factory was practically wiped out by fire, and steps were immediately taken to secure a larger plant in a better locality. Temporary buildings were erected on the old site, sufficient to carry on a limited business until March of this year, when the business was moved into the new factory erected in Long Island City for the purpose.

The company bought, last summer, five acres of land between Borden Avenue and Newtown Creek, Long Island City, about a mile from the Thirty-fourth Street Ferry. It erected a fine factory-type main building 500 ft. long and 100 ft. wide, two-story gallery construction, and which has been surrounded by minor buildings, such as battery room, lumber store, etc. The heavy materials are handled by a Northern electric crane, and a side track from the adjacent Long Island road enters the building. The factory has been planned so as to bring the various operations in wagon manufacture as closely together as possible. A commodious suite of offices occupies a portion of one of the galleries. Parts of the building are here illustrated.

The company started originally with the intention of developing mechanical vehicles for commercial purposes and was prepared to develop such vehicles propelled by either gasoline or electric power. So far most of the work has been in electric vehicles, and the company believes firmly that electricity can be counted upon for the motive power of a large proportion of the trucks and wagons required in the big cities of the United States. It has, however, built trucks

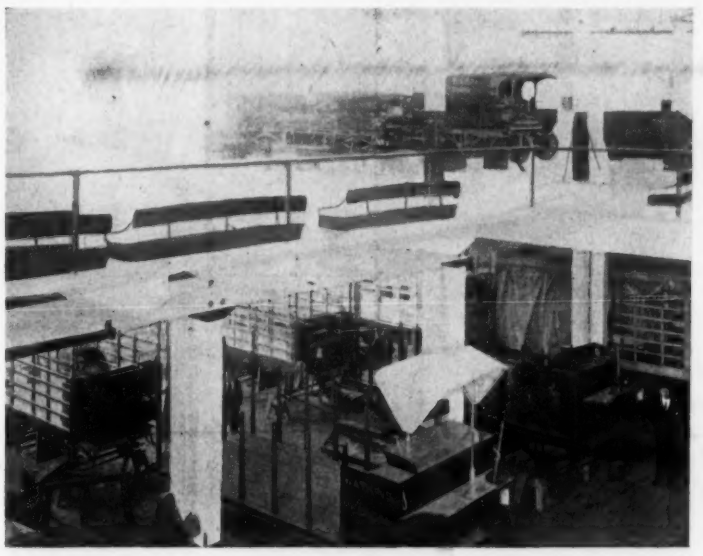


FIG. 2.—A BAY AND GALLERY.

operated by gasoline engines and is prepared to meet any demand for such vehicles in the future.

The Vehicle Equipment staff and executive, while adhering to its original plan of developing and pushing the commercial vehicle, has also developed a line of electric pleasure carriages. The company adopted in the beginning a general arrangement of running gear which it has improved from time to time, but from which it has not departed materially, so that its wagons and trucks of all designs and for all purposes can be recognized by the mechanical features of the running gear. The company has believed that it is to great advantage to have one type of running gear and stick to it until it has some good reason to change. It does not build its own electric motors, nor does it limit itself to the use of either spur gear transmission or transmission by chains, but the frame of the vehicle and the axles,

brakes, steering gear, etc., have been from the beginning of the same general design. The company has developed a number of types of automobiles which have become common on our streets. It built the first "sight-seeing coaches," since come to great popularity in the United States, and it has developed trucks and wagons for a great many special purposes which have become standard types, such as machinery-hoisting trucks, cable-handling trucks, dumping trucks, beer trucks and various other practical vehicles, which are now used, as noted above, by 300 of the merchants in the United States, some of whom are operating a considerable number of vehicles. The best evidence that they are satisfactory is to be found in the "repeat" orders from firms who were the customers of the company four years ago and have increased their number of wagons each year since.

It is not to be denied that in some cases the purchasers have been disappointed, but when it is taken into consideration that they represent less than 2 per cent of the total number of wagons built by the company it is reasonable to infer that the wagons are doing satisfactory work. The company has naturally profited by the experience of the operation of a great many vehicles in the hands of its customers under various conditions of service, and it has abundant data as to the cost of operating electric wagons as well as other kinds of automobiles and horse vehicles, and with this experience and all these facts in its possession it did not hesitate to build this large new factory and acquire a large reserved acreage of property to meet the business which it expects to get in the near future.

The company's product has become standardized as far as the output of any industrial enterprise can be in this rapidly progressive age of electricity. It is not experimenting, and from the beginning has avoided the waste of time required by contests and competitions in its field. It has, perhaps, been over-conservative in this respect as well as in the matter of giving to the engineering profession the results of its experience. All this has been due to the fact that the management decided to concentrate its entire efforts in producing the goods and selling them.

The Vehicle Equipment Company believes, however, that electrical engineers everywhere should be informed of what has been accomplished, feeling that if they could have the facts they would realize that electricity is a good enough substitute for the horse. The larger use of electric wagons means more consumers of electric current and a larger business for the entire electrical industry with an increased number of openings for electrical engineers. In the City of New York, for example, there are probably not more than 2,000 electric vehicles, while it is said that there are about 400,000 horse vehicles of which 10 per cent are pleasure carriages and the balance trucks and delivery wagons. What an enormous opportunity is here opened up; but it is equalled relatively in every city in the Union, and in every town where central stations exist.

The officers of the Vehicle Equipment Company are Robert McA. Lloyd, president; Hector H. Havemeyer, vice-president and treasurer; Arthur Havemeyer, secretary. The directorate of the corporation includes Charles L. Edgar, president of the Boston Electric Company; Marsden J. Perry, president of the Narragansett Electric Company, of Providence; S. M. Hamill, of the General Electric Company; William R. Willcox, postmaster of New York City, and A. J. Baldwin, of New York.

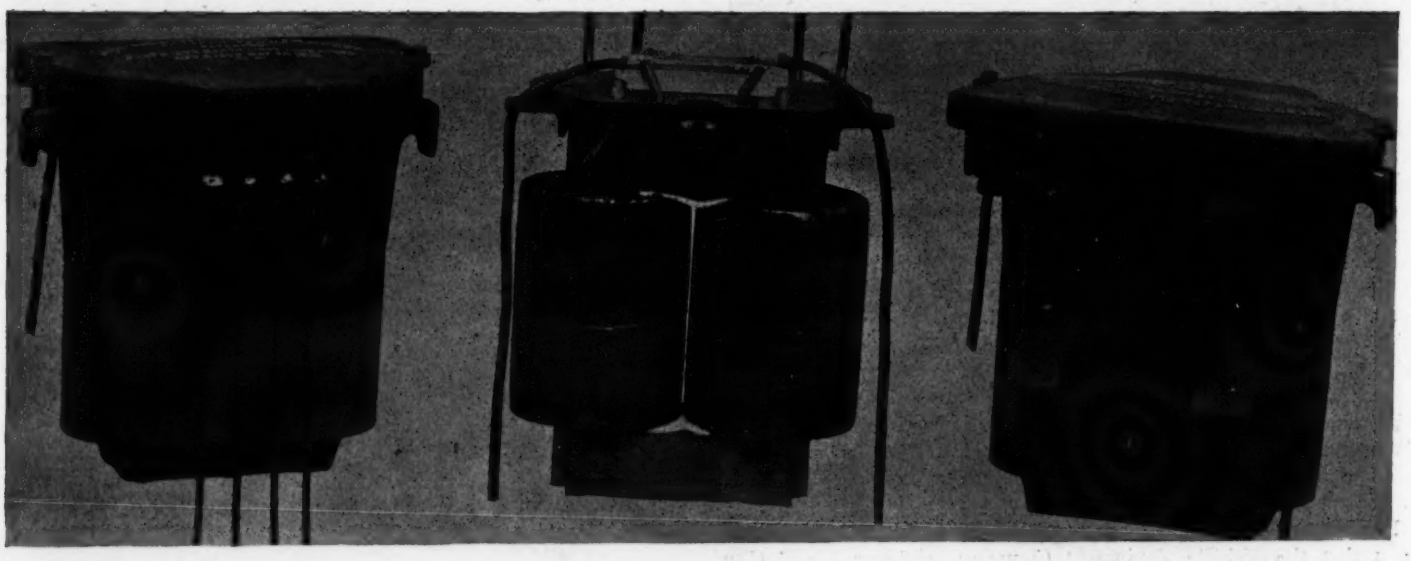
Westinghouse Core-Type Transformer.

The Westinghouse Electric & Manufacturing Company has placed upon the market a new line of core-type transformers, which has been designated Type C transformer. This type has operating characteristics closely approximating those of Westinghouse Type O D transformers; their regulation being extremely close, the efficiency high and operating temperatures low, while a high grade of insulation insures long life under severe conditions. They are intended for general distribution service on 60-cycle circuits operating nominally at 1,050 and 2,100 volts, although they will operate successfully on voltages up to 1,200 and 2,400. They are manufactured in sizes from .6 to 50 kw, all wound for the same primary voltages but divided into classes according to the voltages of the secondary. Class 200 may be connected for either 105 or 210 volts, and class 400 for 210 or 420 volts.

The transformer is enclosed in a cast-iron case with felt gaskets under the lid, so as to make the transformer absolutely weatherproof. For sizes above 20 kw, the case is corrugated to increase the radiating surface, but in the smaller sizes a smooth case has surface sufficient to radiate the heat generated. Hanger irons are provided by which any transformer up to and including 30 kw, may be mounted on a pole.

The core is built up of annealed steel punchings of cruciform shape, and is practically non-ageing. The primary and secondary coils are placed on the long sides of the core, the laminations of which are clamped together at top and bottom by suitable end frames. The low-tension winding is composed of one coil per leg, each coil having two sections so connected that the inner section of one leg is in series with the outer section of the other leg. This arrangement results in a secondary winding of two exactly similar parts both as to resistance and reactance, and insures equal loading of each primary coil irrespective of the method of loading the secondary. A balanced voltage is thus maintained on the two sides of a three-wire distributing system irrespective of the load. The high-tension winding is divided into two coils per leg to reduce the voltage between layers of the winding to a low value.

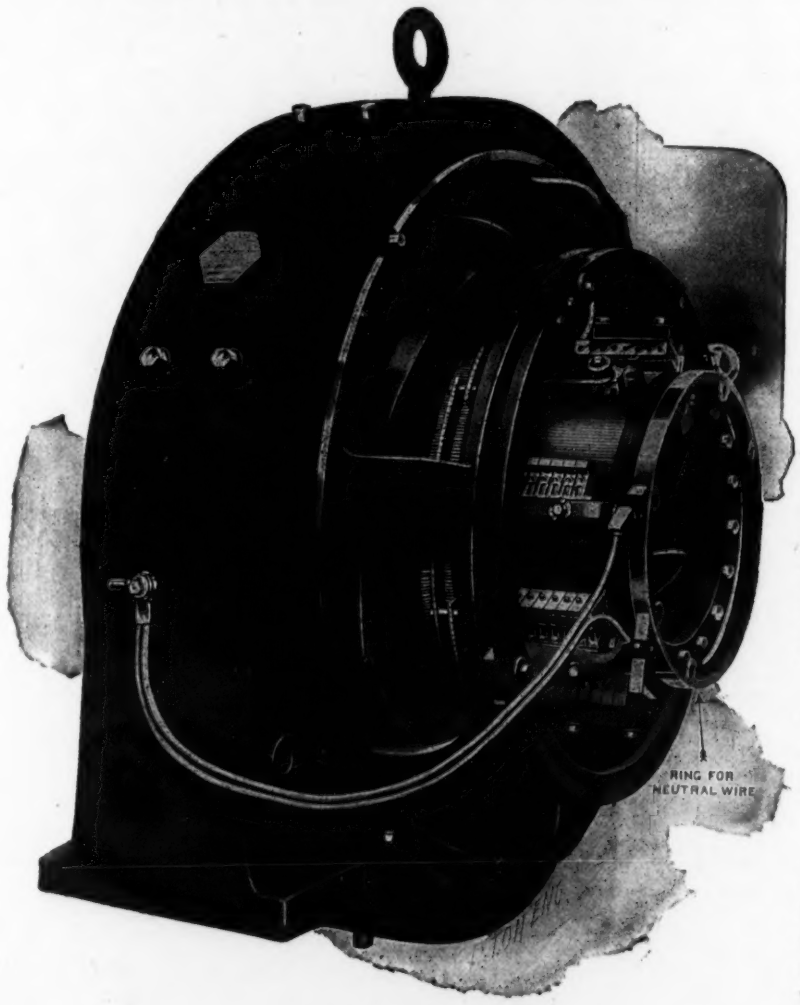
The core-type construction allows the use of a circular coil, which has many advantages. All insulating parts between layers of the winding and between high and low-tension coils are cylindrical in form, eliminating sharp corners so harmful to insulating material. The windings are so disposed and oil ducts so provided that a free circulation of oil between coils and core is obtained, insuring ready dissipation of the heat and preventing deterioration of the insulation. Careful attention has been paid to the insulation, and liberal allowances made to insure a high factor of safety.



Figs. 1, 2, 3.—Core-Type Transformers.

Burke Three-Wire Generator.

The advantages of a three-wire system of distribution have been recognized from the beginning of incandescent lighting. The system was devised by Mr. Edison in the early days of incandescent lighting, and three-wire net works installed at that period in New York, Chicago and other large cities are in satisfactory operation at the present day. In these the voltage between the neutral wire and either of the outside wires is 110 volts and that between the two outside wires 220 volts. Incandescent and arc lamps are connected across the 110-volt lines and motors across the 220-volt lines. Although its many advantages have thus been long recognized, the Edison three-wire system has found very little application except in connection with large central stations, requiring two generators of the same size, which under operating conditions, are considered as one unit. Should either be disabled, it becomes necessary to stop both and disconnect both from the mains. Skillful and competent station attendants are required for this system, which is quite complicated,



THREE-WIRE GENERATOR.

especially when the units are to be connected in parallel with others operating on the same system. Moreover, the probability of a breakdown is always, of course, greater with two machines than with one.

For small plants the Edison system has not been introduced to any extent for reasons above referred to. The complication of the use of two machines where one should fulfill the requirements has led to a system involving the use of a rotating balancer as a step toward simplicity. This method consists of a single generator which supplies two smaller machines, which are coupled together and are continually in operation. The armatures of these two machines are connected in series, and the neutral wire of the system is connected between the armatures. When the load on the three-wire system is balanced, both machines operate as motors, and no current flows in the neutral wire. If either side of the system is unbalanced, the machine on that side operates as a dynamo and is driven by the machine on the lightly loaded side, which operates as a motor. If these auxiliary machines are not sufficiently large the advantages of the three-wire system are only partially enjoyed, and more complication and greater losses may result than in the system on which it has attempted to improve. The small auxiliary machines consume power continuously while they are running, and make a permanent reduction in the efficiency of the plant. The liability of breakdown is also increased, as there are three machines, any one of which on becoming inoperative will require the load to be transferred to reserve machines, or may cause the entire plant to be shut down if there are no available reserve machines.

To overcome the disadvantage of the above-described methods of operation, a system was devised in which stationary alternating-current transformers replace the rotating balancers for supplying the neutral wire. Although this system was an important step in advance, it is not entirely free from objection as it has introduced the complication of using four collector rings in addition to the regular commutator, and also two balancing transformers. Although the latter possess the advantage of having no revolving parts and are on that account less liable to get out of order, still they increase the first cost of the installation and consume some energy all the time.

The Burke Electric Company, of Erie, Pa., has made an entirely new departure in generators for supplying three-wire systems. The three-wire generators which this company has designed and placed upon the market are entirely self-contained and require no auxiliary apparatus, either rotating or stationary, necessary in the systems already described. By an improved armature winding and arrangement of conductors, the two voltages are generated directly in the armature, a single collector ring being provided for the neutral wire and the current for the outside wires being taken from the commutator in the usual manner. From the accompanying illustration it will be seen that the Burke three-wire generator resembles very closely the standard two-wire generator manufactured by this company, except that a single collector ring has been added. The generators are furnished both in the engine type and belted type, and the same liberal guarantees as to temperature rise, overload capacity and efficiency apply to these three-wire generators as for the standard two-wire generators of the Burke Electric Company.

A 150-kw engine-type machine has been in operation in the plant of the Flaccus Glass Company, at Tarentum, Pa., for some months with entire satisfaction, all guarantees having been successfully fulfilled. It may also be interesting to note that for the plant which the City of New York is installing for illuminating the new Williamsburg Bridge across the East River, a contract after proper investigation was awarded to the Burke Electric Company for two 100-kw and one 50-kw, three-wire generators.

Fort Wayne Series Alternating-Current System of Arc Lighting.

Although the many advantages of the alternating-current system for series arc lighting are well known, and although systems of this kind have been in operation throughout the country for some time, the further advantages of a simple system, requiring but slight attention, which is sufficiently flexible to operate in parallel with an incandescent system if desired, will at once be manifest. The Fort Wayne Electric Works has recently developed a complete system along these lines, which is described below.

The system consists, briefly, of a regulator for maintaining a constant current, a specially designed high-tension switchboard, a constant-potential transformer, and a line of arc lamps. In addition, both sides of the line are equipped with lightning arresters peculiarly adapted to circuits of this nature.

Fig. 1 represents the regulator which has been designed for this system. Its operation depends upon the automatic introduction of impedance into the lamp circuit whenever any decrease in the resistance of the latter would tend to cause an excessive current to flow therein. This impedance is introduced by the combined movements of a laminated iron core and impedance coil into such a position as to cause a greater magnetic flux to be cut by the current in the coils. The increase in the amount of flux cut by the line current produces a choking effect, reducing the latter to its normal value. If, for any reason, the line current be decreased, the exact opposite effect takes place within the regulator and the current is automatically increased to its normal value.

The mechanical parts of the regulator are so well counterbalanced

that the motion of the heavy core is small as compared with that of the coil. This reduces the inertia and guarantees an immediate and more sensitive adjustment of the current. This design also permits the core and the coils to counterbalance each other, and does away with the use of the counter-weight thereby simplifying the design and reducing the necessary attendance.

The regulator is very compact in form, requiring a floor space of but 22 x 28 in. in the 75-light size, and may be located upon the floor of the power station in any convenient position. No attention is required at the regulator, the starting operation being entirely controlled from the switchboard specially designed for this purpose.

The switchboard furnished with this system consists of a single panel of blue Vermont marble, equipped with ammeter, reactance, fuses, and all necessary switches for the starting and operation of the system. Fig. 2 represents the front of the switchboard ready for use, equipped with a step-up transformer and integrating wattmeter.

By reference to the accompanying diagram, Fig. 3, the peculiar design will be noted by means of which the system may be quickly started from the switchboard without paying any attention to the regulator and without causing any excessive rush of current through either the regulator or the lamps in so doing. The ability to thus start the system without any disturbance upon the line, is one of the great advantages claimed for the Fort Wayne system.

The starting switch, which is located in the center of the panel, should always be closed last. In the closing of this switch, there are three separate stages. At the first stage a reactance which is mounted upon the back of the switchboard, is introduced into the regulator circuit, so that no rush of current will take place when the regulator is thrown upon the line. If it were not for the introduction of this reactance, the regulator, which is in its no-load position and introducing but very little impedance in the circuit, would permit an excessive current to flow. With the introduction of the reactance, however, the current is choked down to its normal value until the regulator comes to its full-load position, in which position it introduces a sufficient impedance of its own to reduce the current to its normal value. In the second stage this reactance is short-circuited, thus throwing the regulator, which has now reached its full-load position, directly across the constant potential bus-bars. During both these stages the line leading to the arc lamps is short-circuited.

When the starting switch is entirely closed the short-circuit across the line which previously existed is removed, thus permitting the line of arc lamps to operate in series with the regulator upon normal current. By thus connecting the lamps into the circuit after normal current has already been maintained, no disturbance is caused in the mechanism of the lamps.

Although the systems for 12 and 25 lights will operate satisfactorily without the use of a constant-potential transformer upon circuits of 1,100 and 2,200 volts respectively, it is advisable to use a transformer in all cases, although it may be of a one to one ratio, introduced merely for insulation purposes. This is especially desirable where both arc and incandescent systems are operated from one set of bus-bars, in order to entirely insulate the arc system from that which supplies the incandescent lamps.

Fig. 4 represents the constant-potential transformer used with this system, which may step-up or step-down the bus-bar voltage, or may maintain the same voltage upon both primary and secondary in cases where it is introduced for insulation purposes only. The secondary of this transformer is provided with a number of taps,

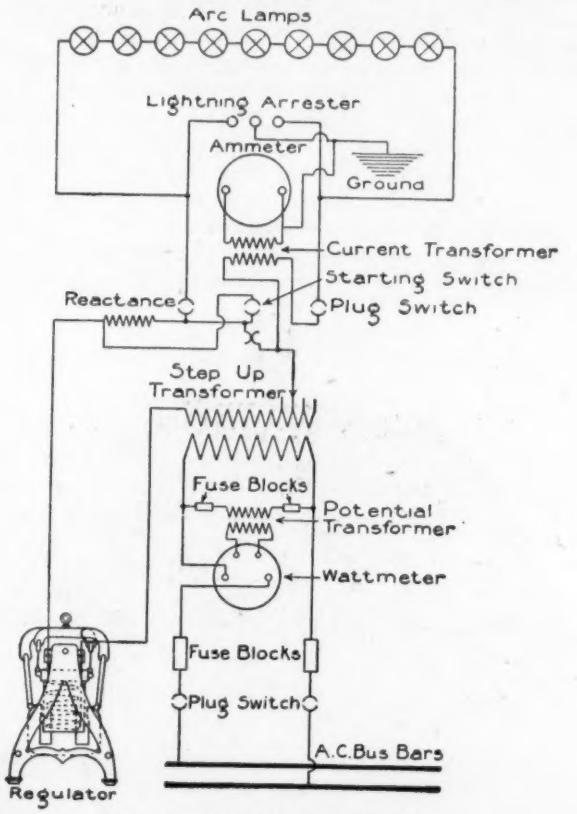


FIG. 3.—DIAGRAM OF CIRCUITS.

FIG. 1.—FORT WAYNE REGULATOR.

FIG. 2.—SWITCHBOARD.

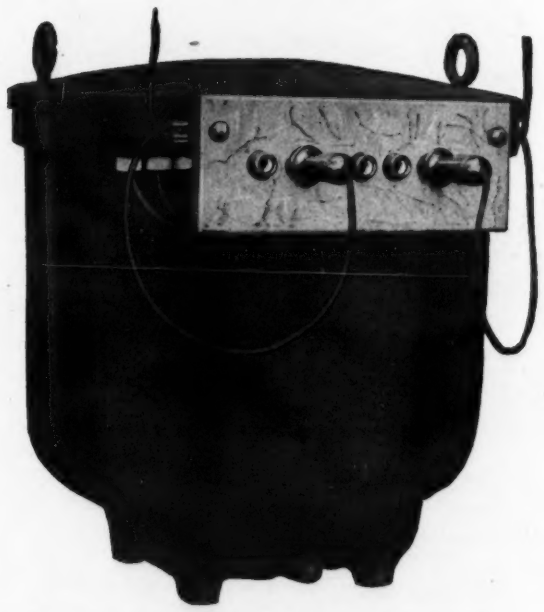


FIG. 4.—CONSTANT-POTENTIAL TRANSFORMER.

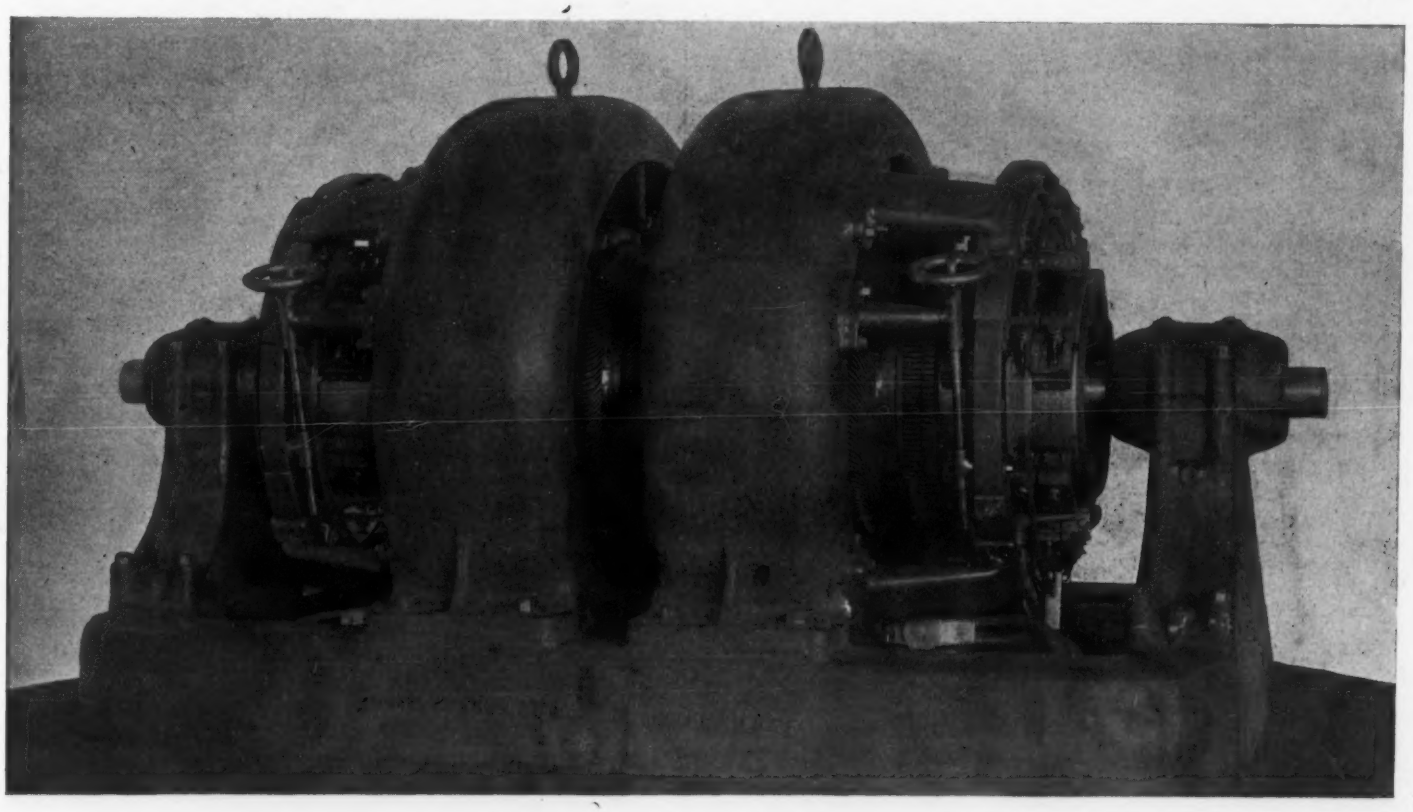
by the use of which the output of the station may be varied as more arc lamps are needed upon the circuit, thus maintaining at all times practically full-load efficiency and power factor. The advantage of this will be at once apparent. If a regulator and transformer is selected of sufficient capacity to meet the needs of a growing system, the latter may be connected at first so as to supply only a small portion of its total output, and, as the number of arc lamps increases, the taps upon the transformer may be so connected as to meet this demand with no further cost of installation. This may be done with practically no sacrifice of efficiency when operating the circuits of small capacity.

The alternating-current, series arc lamps which have been designed to operate in connection with this system operate with extremely low temperatures for periods of time up to 125 hours with but one trimming, when adjusted for normal current of 6.6 amperes. Great care has been taken to prevent vibration and the consequent hum which frequently occurs in lamps operated upon alternating-current circuits.

The system has been designed for either 60 or 140 cycles, and has been found to operate with entire satisfaction upon each of these frequencies. The 140-cycle lamp has been especially designed for high-frequency service and cannot be operated upon a 60-cycle circuit. Although the use of the 60-cycle system is advised wherever possible, owing to the fact that it is at present the tendency for central stations to reduce the frequency of their systems, central station managers who already have 140-cycle circuits have available a system that will operate with entire satisfaction.

Balancers for Edison Three-Wire System.

The balancer set shown in the cut herewith consists of two standard generator frames mounted on a common base and furnished with



BALANCER FOR THREE-WIRE SYSTEM.

two bearings. The generators are shunt wound, for a voltage range from 125 to 250 volts, and the two machines are connected in series across the outside wires of the Edison mains, and are used for the purpose of compensating for any unbalance on either side of the system. Each machine operates as a generator or a motor according as the load on its side is greater or less than that on the other.

These sets were designed to meet the purchaser's specifications. This included temperatures, regulation and sparkless operation under normal conditions, and compactness in design. The sets are so designed that each machine will operate from full load as a motor to full load as a generator, without sparking, the brushes remaining in a fixed position.

The apparatus was planned especially with reference to compactness, so that it would occupy a minimum amount of floor space. Some of these sets have been installed in various stations of the New York Edison Company.

Recent Work with Walrath Gas Engines.

A representative of THE ELECTRICAL WORLD AND ENGINEER, who recently visited the large factory of the Marinette Gas Engine Company at Chicago Heights, Ill., was somewhat surprised to learn that 80 per cent of the output of this large factory in gas and gasoline engines goes into electric lighting plants. This fact indicates that gas and gasoline engines in sizes of from 10 to 150 horsepower, such as is turned out at this factory, are playing a much more important part in electric lighting business than is generally supposed. Nearly all of these engines are built for direct connection to generators, which indicates that the belt is becoming nearly as extinct in small electric light plants as in central stations. These gas engines for lighting purposes do not all, however, go to isolated electric plants.

For example, the Diamond Electric Light & Power Company, which has a plant in the business district of Pittsburg, has in its engine room ten 85-hp, three-cylinder, direct-connected gas engines of this type. The remarkable thing about this type of engine and one which makes its use permissible where the noise of a gas engine would shut out some types is that it makes practically no more noise with a full load than a good high-speed steam engine. This unusual result is stated to be simply due to proper designing and timing of the valves. The governing is accomplished, not on the hit-and-miss plan, but by throttling. The fuel consumption at full load of these engines can be stated roughly at one pint of gasoline or 18 cu. ft. of common city illuminating gas per hp-hour. On natural gas, the consumption is about 12 cu. feet. By using producer gas, the fuel consumption is about 1¼ pounds of coal or coke per horse-power hour. The company also makes gas producers and has recently shipped some complete gas engines and producer plants to Mexico.

Use of the Nernst Lamp in Yonkers.*

The Nernst lamp is a prominent feature to-day in the plans for the decorative illumination of big buildings, but the most significant feature of its recent sales has been its wide introduction by central station companies as a means of attracting business which formerly it had seemed to be difficult or impossible to secure. This business has for the most part occurred where the cost of current consumed to effect a certain lighting result has been the all-important point at issue, and many of the new customers secured through the medium of the Nernst lamp have been small shopkeepers who had been clinging to gas lighting because they believed that incandescent lamp

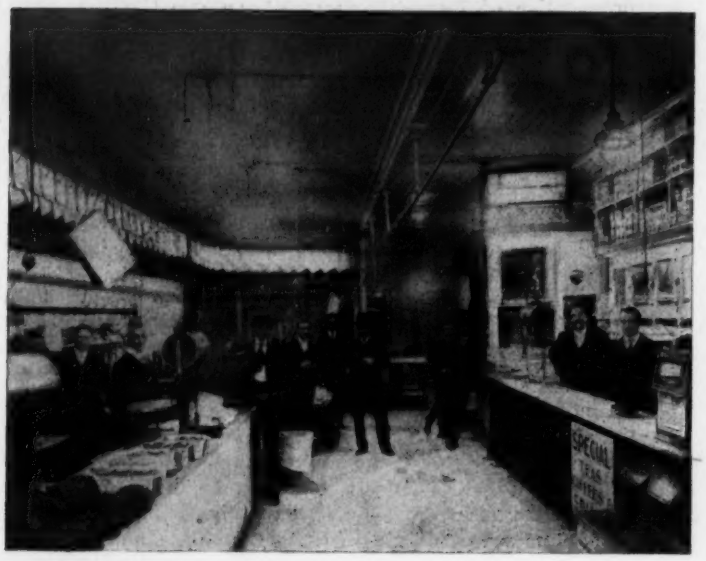


FIG. 1.—INTERIOR STORE ILLUMINATION.

lighting would be too expensive and that arc lamps would not give the form or distribution of light needed. About ninety central station companies have adopted the Nernst lamp for their circuits since the beginning of the year, or more than half as many as the total number of such companies that had previously contracted for its use. One of the most notable instances of its successful employment to win over the shopkeepers of a small city to the cause of electric lighting has been at Yonkers, where the first Nernst lamp was installed in March, 1903. Up to January 1, 1905, the new lamps were installed slowly, but on August 1, 1905, there were 1,836 glower units, or about 800 lamps in all, in service among about 300 customers, the lamps installed being chiefly of the two and three-glower types. Almost all of these lamps have been supplied to former gas customers, and the business of the Yonkers Electric Light and Power Company has grown enormously during this period. At the present time about 200 glower units a month are being installed.

Every barber shop in Yonkers is lighted by Nernst lamps. So is every quick-lunch counter and restaurant. So are 8 saloons, 8 shoe stores, 9 butcher shops, 11 grocery stores, 4 candy stores, 2 florist shops, 2 opticians' shops, 4 jewelry stores and 100 or more other establishments within a mile of the New York Central railroad station. The shopping section of Yonkers has been more or less transformed. On Saturdays the Nernst lamp shops are nearly all lighted until midnight, the lighting in many of them being continued for window display advertising after the doors have been closed.

About fifty lamps are hung out of doors for entrance or window illumination, and a good many others are used for interior window lighting, one lamp to a window, so that the general street lighting effect is considerably enhanced. Many of the shops in which the new lamps have been installed are still equipped with old gas mantel fixtures and arc lamps, which are never lighted. The Nernst lamps have been supplied free by the lighting company, and, almost without exception, they are attached directly to the ceiling or hung from a small bronzed rod given with them, so that no expense whatever has been placed upon the customers for fixtures. An important feature, also, of the argument in favor of the new lamp has been, of course, that the expense of wiring has been reduced to a minimum —about a third that necessary for a satisfactory incandescent installation—the Yonkers shops for the most part being lighted from three or four outlets, two for the salesroom and one for each window.

Shop keepers who could not have used the arc lamp economically have found in the graded units of the Nernst lamp opportunity for a system providing an equally cheap and more effectively distributed maximum illumination, while possessing a flexibility which makes it possible to consume only the actual amount of current needed at any one time. By lighting each dark section of the shop separately, as evening comes on, and by continuing the Nernst lamp illumination of the window display alone, after the shop itself has been closed, the customer is confident that no current is being wasted at any time, and he is encouraged to light his store more brilliantly than he has ever done before. Recognizing the high efficiency of the Nernst lamp with which almost twice as much light is obtained per kilowatt hour as from incandescent lamps, many former incandescent lamp customers have profited by it. The customers have not decreased their bills, but they have secured a more liberal lighting with the Nernst at the old cost of incandescent lighting. Since the introduction of the four-glower lamps, five different sizes of Nernst lamps have been on the market—the single-glower lamp, approximating 60 cp; the two-glower lamp, of 125 cp; the three-glower lamp, of 200 cp; the four-glower lamp, of 300 cp; and the six-glower lamp, of 500 cp—the lamp's efficiency increasing as the number of glowers grouped together is increased. The recent advent of the composite type Nernst lamp, which is so constructed that half the

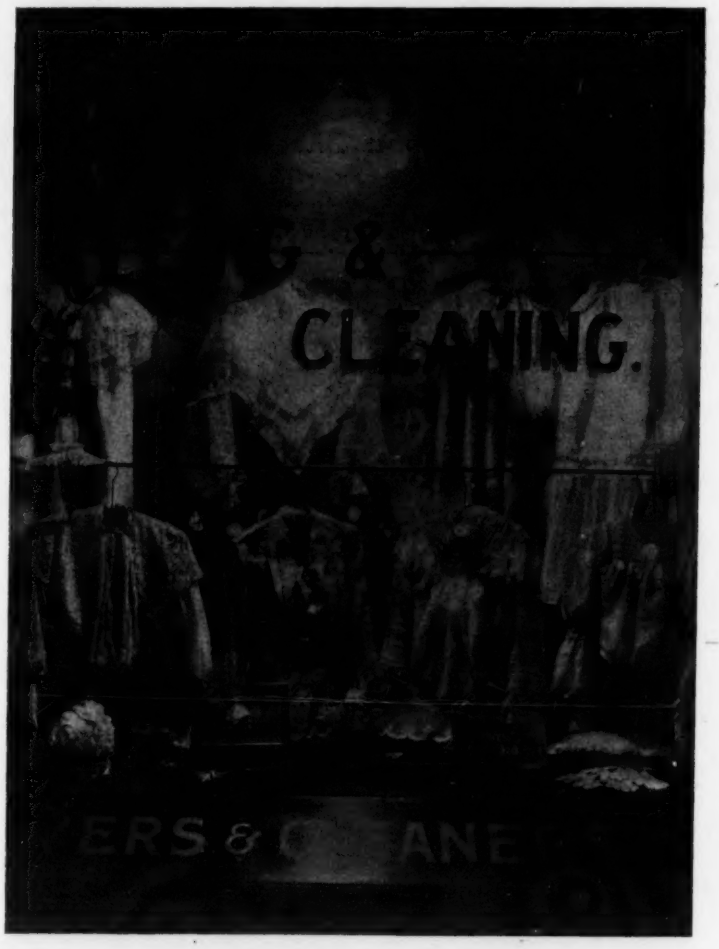


FIG. 2.—EXTERIOR OR WINDOW LIGHTING.

glowers may be cut out when desired, thus reducing the current consumption one-half, has still further improved the flexibility of the system.

The systems of direct-current distribution still obtaining in most large cities have shut out the Nernst lamp in its present form from several of the most important markets, but its popularity has developed rapidly in hundreds of communities throughout the country where alternating current has been available. Along the alternating-current circuits of the Brooklyn Edison Company, in South Brooklyn and Greenpoint, the lamp has been installed in small shops even more extensively than in Yonkers, in the past year. Transformations similar to that at Yonkers have also been effected in many small cities and villages of the Middle West. Up to July 1, 1905, the Detroit Edison Company had installed 503 three-glower lamps.

In St. Louis, where the lighting company began to furnish Nernst lamps throughout its alternating-current circuits last September, after 1,500 glower units had been successfully used for several months to light the Fine Arts Galleries at the Louisiana Purchase Exposition, 3,336 glower units had been installed up to July 1 of this year. It is stated that 95 per cent of the cases of dissatisfied customers arising on the alternating-current circuits in that ten months' period were retained with the aid of the Nernst lamp, and that 60 per cent of the total Nernst lamp business was secured from former gas consumers.

From the point of view of the central station company, the Nernst lamp has been a valuable "find" not only as an effective weapon with which to meet low gas prices, and as a means of increasing the general demand for electric lighting and of securing former private plant business, but as a solution of many of the problems of current distribution and of load equalization. The acquisition of long-time customers has tended to broaden the load peak, and to build up a profitable after-peak business. Stations have found that the installation of high efficiency lamps minimizes the percentage of unprofitable installations, and that feeder cables laid to accommodate the highest load that might be put upon them, are much more likely to carry a load approximating that maximum with high efficiency lamps than with low efficiency lamps which customers find too expensive for liberal use. Some of them have appreciated, also, the truth of the argument that the investment in a low efficiency lamp does not end in the lamp itself, but means larger boilers, larger engines, larger generators and a more expensive distribution system, necessitating rates sometimes difficult to maintain and sales expenses that are a heavy burden on the balance sheet. The cost of maintenance of the Nernst lamps in small-shop service has been variously reported by central station companies as from 4½ mills to 1 cent a kw-hour. The cost of maintenance on the lines of the Allegheny County Lighting Company, of Pittsburg, where the Nernst lamp load is now over 600 kw, has varied only slightly from 5 mills a kw-hour in the past two years.

Electrical Recording Instruments.

A well-developed line of recording instruments which have become widely used throughout Europe on account of their reliability in service is being placed upon the American market by E. H. du Vivier, 14 Church Street, New York, as sole representative in this country for the manufacturer, Jules Richard, of Paris, France.

The electrical instruments are of the true recording type, as distinguished from the indicating and integrating types. In each case the record is made upon a sheet carried by a cylinder which is driven by an accurate French clock mechanism. The clockworks are contained within the cylinder, so that they are well protected and, although requiring but little attention, they will retain their accuracy for a very great length of time. The paper which is placed on the cylinder is graduated in the circumferential direction to accommodate 26 hours, so that each sheet may represent a run of one complete day. For special or testing purposes the speed of the cylinder can be given any value desired. The graduations in the axial direction represent the instantaneous readings, and vary according to the capacity of the instrument. It is worthy of note that the record is equally as legible as though it were plotted to rectangular co-ordinates. (See Fig. 1.)

The recording device is extremely simple. It consists of a "fountain" pen carried by an aluminum arm whose position is determined by the quantity being measured. In a triangular-shaped cavity in the pen is carried a sufficient quantity of a specially-prepared ink for operation for more than a week. The arm possesses sufficient elasticity to insure uniformity of contact between the pen and the paper in all positions, while a thumb-screw allows the pressure of the pen upon the paper to be varied as desired.

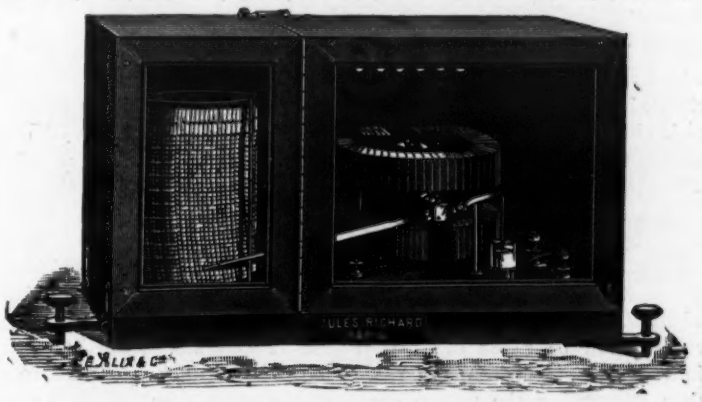


FIG. 2.—RECORDING WATTMETER EQUIPPED WITH GLYCERINE DASH-POT.

The instruments are of the aperiodic or "dead-beat" type, each being provided with some device to cause the arm quickly to assume its final position without vibrations. Each ammeter or voltmeter which is equipped with permanent magnets is provided with an electromagnetic dampener. This device consists of a short-circuited coil of low conductivity in which eddy currents are produced when it moves through the flux of the permanent magnets so that all rapid motions or vibrations of the arm are thereby prevented. The dynamometer type of instruments are equipped with glycerine dash-pots to deaden the vibrations.

Fig. 2 shows a recording wattmeter of the dynamometer type. The stationary coils carry current proportional to the current in the circuit, while the movable coil carries current varying in value with the voltage of the circuit. The graduations of the chart are uniform over the whole working range of the instrument. In comparison with a so-called integrating wattmeter the instrument possesses the advantage that it not only records the total consumption of energy, but at the same time it shows and records continuously as a function of the time the power used at each instant. The shaft of the moving coil rests on knife edges allowing free movement of the parts, and the oscillations of the pen are dampened by a glycerine dash-pot, as indicated previously.

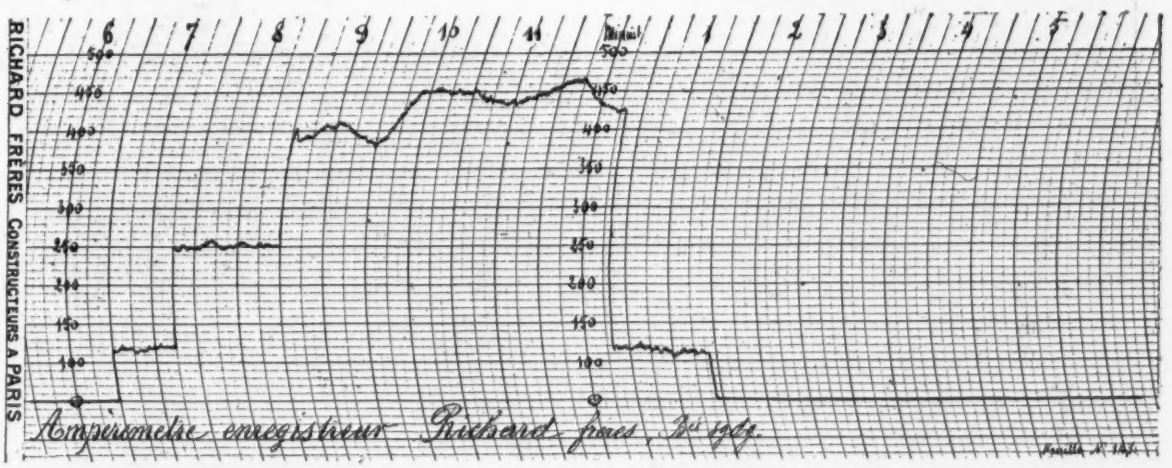


FIG. 1.—CHART OBTAINED FROM A RECORDING AMMETER.

The wattmeters are built for both direct and alternating currents, the latter instruments being of either the single-phase or polyphase type. The voltmeters and ammeters are of the dynamometer, hot-wire or moving-vane type for both direct and alternating-current

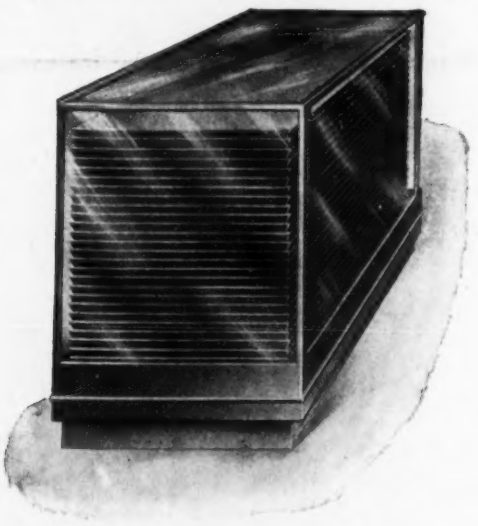
work, or are of the permanent-magnet type for direct-current service exclusively. Each of these instruments is equipped with a recording mechanism similar to the one illustrated in Fig. 2. In the design and construction of these instruments special attention has been given to obtaining initial and continued accuracy, and service tests have shown that they fulfill all requirements in these respects.

Alternating and Direct-Current Generators

The R. M. Cornwell Company, of Syracuse, N. Y., has recently added to its line of small machines the "Wonder" alternator, which is claimed to be the only small machine on the market which will furnish either direct or alternating current. With it all kinds of experiments can be performed that require an alternating current. The machine has a laminated armature. All parts are interchangeable, and the arrangement is such that the machine can be easily taken apart to show the general construction throughout, thus being especially adapted for experimental purposes in schools and colleges. It has an output of 12 watts, and is wound for a number of different voltages. When operating as a generator, alternating current can be taken off on one end to run lamps, small transformers, etc., and from the direct-current end motors can be run, thus illustrating the two currents at the same time. It will also operate as a motor on a 110-volt direct-current circuit, by using a lamp in series.

Tray Type of Storage Battery.

A type of battery whose constructional features and operating characteristics are stated to be such as to render it especially fit for stationary service of even the severest kind is shown in the accompanying illustration. The battery is composed of one or more vertical piles of units. Each unit consists of a sheet of chemically pure rolled lead formed into the shape of an ordinary pan or tray with



TRAY STORAGE BATTERY.

flaring sides. Each tray is subjected to a special electrochemical treatment by means of which the active material, in which the energy is to be stored, is formed upon the two sides of the tray bottom, that on the inside being usually positive and that on the outside negative. Each tray then becomes within itself the negative plate of one cell, the positive plate of the next cell, and a connector between the two; the conducting cross-section of this connector is equal to the entire plate area of the cell instead of being restricted to a narrow strip or lug, as in the usual type.

The tray units are piled one above another, with separators between, thus providing an open space for electrolyte between successive units. The upper side of the bottom tray, the electrolyte therein and the bottom side of the second tray form the first cell; the top side of the second tray, its electrolyte and the bottom side of the third tray form the second cell, and so on, each additional tray adding one cell and increasing the pressure of the pile by two volts. The whole pile is enclosed in a dust-proof glass case which can be easily opened for inspection, the whole making an exceedingly neat, convenient and attractive structure.

The charge and discharge rates of these batteries are limited only by the rise of temperature which may be caused by an excessive rate too long continued. The rating, however, has been placed on a conservative basis; that is to say, there has been allowed a superficial area of 250 square inches per ampere. It is stated that even a short-circuit will not buckle the plates or loosen the active material, and that if the cell is immediately recharged it will not show any immediate evil results.

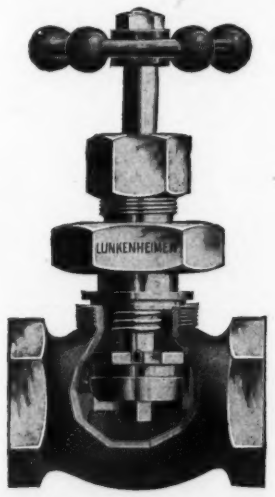
As contributing to both durability and rapid discharge rate, it will be noted that, when the battery is being charged, the current, which enters the lower tray, distributes itself over the entire area and passes upward from cell to cell through the entire pile. When discharging, the action is the same, only the direction of flow is reversed. Every unit of plate area is, therefore, worked at the same rate, and every square inch is doing its full duty. On account of the uniform distribution of current the area of the conducting path is rendered extremely large, and the result is a proportionate reduction of the internal resistance in that part of the circuit.

This battery is the invention of Mr. Malcom O. Smith. It is being placed upon the market by the Smith Storage Battery Company, Zoar, Ohio.

Regrinding Globe Valve.

A globe valve which has recently been the subject of numerous improvements in details is shown in section in the illustration. It will be noticed that the hub which carries the operating stem is secured to the body by a union connection, which, in turn, screws over the shell of the valve body. By means of this construction it is impossible for the hub and the body to become corroded together, as the thread which holds the union ring to the body is protected at all times from the action of the steam, the joint being made between the flange on the hub and the neck of the body. This connection also acts as a tie or binder in screwing over the body, and tends to make the valve rigid and strong.

The stem is fitted with a very strong, durable and long thread,



REGRINDING GLOBE VALVE.

and the manufacturer states that the valve is very easy to operate, and that there is practically no exertion necessary to close tightly even its largest valves. The reason for this is that the hand wheels are so proportioned in respect to the seat opening that no additional leverage need be applied to the hand wheel to facilitate the operation of the valve.

To regrind the valve the bonnet ring is unscrewed, and the trimmings are removed from the body. A wire or nail is placed through the lock-nut and stem, a little powdered sand, or glass and soap, or oil is placed on the disc, and the trimmings are again placed on the valve and reground.

The Lunkenheimer Company, the maker of this valve, in connection with its plant at Cincinnati, Ohio, has a complete physical and chemical laboratory, which enables it to manufacture its products of such composition as is best adapted to withstand the chemical actions, strains, etc., to which the various products are subjected.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Business conditions and trade in general were excellent during the past week, and the cool weather, while it has not materially affected holiday expenditures, has helped to key up industry, so that after Labor Day, a very pronounced briskness is likely to be noted in every direction. The activity in all branches of the electrical industry is well maintained, and the large amount of new building holds out bright hopes for the future. Discussing trade conditions, *Dun's Review* says: "Distribution of autumn merchandise is in progress unusually early this year, and the volume of forward business is so heavy that the last half of 1905 promises to establish a remarkable record of commercial activity. Current retail trade is well maintained, the urgency of orders received by jobbers indicating that dealers' stocks are becoming depleted, and there is little complaint regarding collections. More labor disputes have reached settlement, and no serious controversies are threatened, while in many sections the supply of wage earners is inadequate. Freight blockades and insufficient rolling stock cause delay, despite widely extended facilities as compared with last year, and this trouble will probably increase as the crop-moving season advances. Special reports regarding manufacturing conditions have been received from about forty leading industrial centres, and there is surprising unanimity in the statements. With scarcely an exception, plants are working close to full capacity, with little idle machinery, except where alterations or improvements are in progress, and contracts on hand far exceed those held at this date in 1904. Equally gratifying is the confidence expressed in the future, a prominent feature of most reports." Liabilities of commercial failures thus far reported for August amounted to $4,917,390, of which $2,005,081 were in manufacturing, $2,616,472 in trading, and $295,837 in other commercial lines. Failures last week numbered 190 in the United States against 205 last year, and 27 in Canada compared with 30 a year ago. An evidence of the general confidence is seen in the large orders given by the railroads for new equipment, rails, cars, locomotives, etc. Yet President Gary, of the United States Steel Corporation, says: "One of the most satisfactory features of the present position of the steel trade is that, notwithstanding the enormous demand for steel products of all kinds, there has been no inflation of prices. There is nothing of the character of a 'boom' in the present prosperity of the country's chief industry. Prices are firmly established and at a fair level. Were it not that the present policy of the leading manufacturers is to prevent abnormal movements in the price of steel products, much higher prices than are now being paid could be secured for many products. Consumers would gladly pay more than present prices to have their orders filled at an early date, but it is not possible for the mills to produce material as fast as it is needed by consumers." The upward tendency of the price of copper, now well over 16 cents, is discussed in another item.

THE POSITION OF COPPER has grown to be one of profound and wide-reaching interest, and there is good reason to expect that this will continue without abatement. We have frequently directed attention, says the *Copper Gossip* of the National Conduit & Cable Company, to the enormous increase in the exports of copper, and this feature of the situation may be said to form the sole reason for the marked firmness prevailing during the past 12 months. The exports for the first seven months of 1905 amounted to 332,144,960 pounds, against 299,116,160 pounds for the first seven months in 1904. If the domestic production for the current calendar year is estimated at 875,000,000 pounds, the above rate of export, if maintained throughout the entire year, would represent 65 per cent of the United States' production. Imports into this country for the first half of this year were 98,784,000 pounds, and at this same rate the quantity of imported copper for 1905 would amount to 197,568,000 pounds. Adding imports to production, the new domestic supplies for 1905 aggregate 1,072,568,000 pounds. If the same ratio of exports continues as for the first seven months, the total quantity of copper exported this year will reach the unprecedented amount of 569,391,360 pounds, or 53 per cent of the United States production and imports for the year, as per figures stated. With a foreign demand of such dimensions for the copper produced here and imported into this country for refining, there is no difficulty in explaining why values have risen. Domestic demand is also a large and growing factor to be reckoned with, and with present excellent business conditions the course of the copper market is not to be wondered at.

THE GREEN FUEL ECONOMIZER COMPANY, of Matteawan, N. Y., has just completed the erection of a large shop designed to provide for its rapidly increasing business. This company not only supplies special exhausters with bearings removed from the action of the flue gases for mechanical draft in connection with the Green economizer, but also builds fans, blowers and exhausters for every purpose, having, for instance, recently sold fans for heating, ventilating and humidifying in textile mills, ventilating and drying in paper mills, heating and ventilating in large buildings, etc. It is just now installing the largest mechanical draft exhauster ever built, for a factory in Massachusetts. New designs have been worked out for all types of "Green-Matteawan" fans with the special object of reducing the power required for driving. Fans are often driven by small non-condensing engines or by electric motors using purchased power, so this is quite an important matter. The Green Fuel Economizer Company does not contract for the engineering of plants, or for the installation of heating and ventilating plants in competition with the heating and ventilating contractors, but offers the benefit of its engineering skill and sixty years' experience in the construction and operation of air-moving plants.

PENNSYLVANIA WATER POWER.—Bids will be received until Sept. 1 by Geo. W. Wagenseller, secretary Middlecreek Electric Company, at Middleburg, for constructing a complete water-power electric plant, 100 hp, on Middlecreek and Penns Creek, two miles south of Selinsgrove. The bids will cover the work as a whole, and on portions of the work as follows: Solid concrete dam, 17 to 20 ft. high and about 360 ft. long; to dig a tunnel and waterway 1,225 ft. through a mountain; a power house; 2 units with wheels direct-connected generators; auxiliary engine and boiler, and complete equipment, with 25 or 30 miles of line construction, to furnish light, heat and power to Selinsgrove, Sunbury and Northumberland. The officers are Geo. W. Wagenseller, secretary, and F. W. Darlington, Real Estate Trust Building, Philadelphia, Pa., designing engineer.

THE ATHOS ELECTRIC CHEMICAL COMPANY, a Maine corporation, whose experimental laboratories are in Worcester, and in which some Worcester capitalists are interested, has closed a deal for the erection of a manufacturing establishment in New Jersey on the bank of the North River, opposite Ninety-sixth Street, New York. The company will manufacture a deodorizing and disinfectant compound. James H. Mellen is the treasurer of the company. In addition to Mr. Mellen there are included among the board of directors these Worcester men: Harry V. Prentice, A. C. Johnson and H. H. O'Rourke.

SUPPLIES FOR NAVY YARDS.—Bids will be received until September 12 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Dynamo, electric drills and supplies, insulation of electric lights, etc.; engine, pipe and fittings, steel conduit and fittings, cable, cylinder, copper, sheet bar and tool steel, etc. H. T. B. Harris, Paymaster-General, U. S. N.

ADDITION TO PLATINUM PLANT.—Baker & Company, Inc., refiners and manufacturers of platinum, of Newark, N. J., and New York City, are making extensive additions to their Newark works. The rapidly increasing consumption of platinum in the industrial arts has made this extension necessary, especially in their refining department, which will be enlarged over one hundred per cent. New and larger offices are also being erected, and the entire plant equipped with the most modern appliances for the economical manufacture of their varied and high grade products.

WATER POWER IN PORTO RICO.—Bids will be received until December 2 by the Executive Council of Porto Rico for a franchise for the development of a certain water power known as Comerio Falls, situated on the La Plata River, approximately 17 miles in a direct line from San Juan and at an elevation of about 85 meters above sea level, which falls are estimated to be able to develop about 1,000 hp as a minimum and at times more, depending on local rains. Address chief clerk of the Council.

LA GRANGE PLANT.—The date of opening of bids for furnishing machinery and constructing an electric light plant at La Grange, Fla., has been extended from Sept. 5 to Sept. 15. Address S. H. Truitt, chairman Electric Light Committee. Engineers, Ludwig & Company, 513 Empire Building, Atlanta.

DE LAVAL STEAM TURBINE ORDERS.—Below is a list of the principal orders taken by the De Laval Steam Turbine Company, of Trenton, N. J., dating from July 1, 1905: Lawrence Duck Co., Lawrence, Mass., one 225-hp steam-turbine dynamo; Public Service Corporation of N. J., Paterson, N. J., three 75-hp De Laval-Sirocco blower sets; Semet-Solvay Company, Syracuse, N. Y., two 50-hp, alternating-current, electro-motor pumps, fifteen 10-hp, alternating current and direct-current electro-motor pumps; Springfield Boiler & Manufacturing Company, Springfield, Ill., one 150-hp, steam-turbine centrifugal pump, one 30-hp, 20-kw steam-turbine dynamo, for Mississippi River dredge for government; Armour & Co., Chicago, Ill., one 75-hp, steam-turbine centrifugal pump; Power & Mining Machinery Company, New York City, two 300-hp, 200-kw steam-turbine alternators; Massachusetts Chemical Company, Walpole, Mass., one 300-hp, 200-kw steam-turbine dynamo; Gold Prince Mines, Animas Forks, Col., three 300-hp, 200-kw steam-turbine alternators, two 30-hp, 20-kw steam-turbine driven exciters; Board of Control of State Institutions, Iowa, one 75-hp, 50-kw steam-turbine dynamo; California Gas & Electric Corporation, Oakland, Cal., one 150-hp De Laval-Sirocco turbine-blower set (duplicate order); Indianapolis Gas Company, Indianapolis, Ind., one 75-hp De Laval-Sirocco turbine-blower set; City of Georgetown, S. C., one 55-hp turbine pump; Walter Baker & Co., Ltd., Milton, Mass., two 55-hp turbine dynamos; Atlanta Gas Light Company, Atlanta, Ga., one 55-hp turbine-blower set; Denver Gas & Electric Company, Denver, Col., one 55-hp turbine-exhauster set.

THE PALMER MOUNTAIN TUNNEL property in Washington is now in the hands and under control of Massachusetts people. The executive officers are John Tilley, of Holyoke, Mass., president; F. G. Burnham, vice-president; E. E. Barr, of Springfield, Mass., second vice-president; Samuel Porter, of Florence, Mass., treasurer; Leo. H. Porter, of Northampton, Mass., secretary; John Boyd, manager. They with F. E. Goolall, of Spokane, comprise the board of directors. The company is having water and electric power plant especially constructed to suit conditions, and expects to have it on the ground early in September. It consists of a 750-hp Escher-Wyss turbine wheel, under construction by the Allis-Chalmers Company, to be operated under a 365 foot head, on Touts Coulee Creek. Directly connected with it will be a Bullrock alternating current, 750 hp generator. A one-quarter inch steel penstock of 27 inches diameter and nearly 800 feet long is being manufactured at Holyoke. These will be followed by the installation of electric power service for the mines. Next will come a 300-ton stamp and cyaniding mill. C. S. Reitze will have charge of the electrical construction and equipment. L. J. Regali is the local representative for the Palmer Mountain Tunnel & Power Company.

CONTRACTS FOR HAWAII.—The Westinghouse Electric & Manufacturing Company has sent Thomas Anderson to Honolulu to report to the Hawaiian Electric Company, which has the contract for the installation of a water-power electric transmission for the McBryde Plantation Company on the Island of Kauai. The original contract called for two 1,200-kw, 3-phase Westinghouse generators. These are to be directly connected to Pelton impulse wheels. Several wheels of different sizes will be placed on each shaft, so that the amount of power developed can be adapted to the quantity of water available at different seasons. Additional contracts have been closed for a 1,000-hp induction motor and a 500-hp induction motor of Westinghouse manufacture. Current will be transmitted at 33,000 volts for operating irrigation pumps, as well as general power and lighting business.

COOPER-HEWITT LAMP IN JAPAN.—An exhibit was recently given of the Cooper-Hewitt lamp to the Japanese Emperor. The occasion was the graduation ceremony of the Tokio Imperial University, July 11th, this year. The Emperor attended the ceremony as an exceptional case, as he very seldom goes out of his palace. Among the few exhibits which were made, the mercury lamp attracted his attention most. The head professor of electrical engineering, Prof. H. Nakano, a post-graduate of the Cornell University, year 1889, had the honor of explaining the working of the lamp before the Emperor. The lamp was a 48-in. one and was supplied by the Japanese engineering and contracting firm of Takata & Company, 10 Wall Street, who are the agents for the Westinghouse Electric & Manufacturing Company in Japan.

ALABAMA PLANT WANTED.—Bids will be received until Sept. 4 by B. B. Guthrie, town clerk, for a water and light plant, work to include erecting a brick or concrete block power house, furnishing a 100-hp, high-speed automatic engine; two 100-hp boilers and fittings, furnishing 1 compound, 1 duplex and 1 feed pump; furnishing and erecting an 80,000-gal. steel tank and tower; constructing an 80,000-gal. surface reservoir, and furnishing a 60-kw, 60-cycle, single-phase, 2,300-volt alternator, together with exciter, switchboard and station instruments; pole line, transformers and 20 standard 6.6-ampere, series inclosed arc lamps of latest design. Edgar B. Kay, engineer, Tuscaloosa, Ala.

NEW YORK CONSTRUCTION.—Building is not only active in tunnels and new railroad projects in New York, but in offices and homes. The building season, which has been more active than in any preceding year, is drawing to a close. The money involved this season has been tremendous. Since the first of the year permits have been filed for buildings involving an outlay of $155,000,000, while alterations aggregate $13,500,000, a total of $168,500,000. Mortgages, loans and real estate transactions since the first of the year aggregate $625,000,000 in Greater New York. A great deal of electrical work has been involved in isolated plants, wiring, motor drives for factories, etc.

ELECTRIC DREDGERS FOR CALIFORNIA.—The General Electric Company is making deliveries on ten sets of gold-dredge equipments under a contract with the Boston Machine Shop Company, of Oroville, which installs the machinery. Nearly all of the equipment will be placed in dredges operating in the Yuba River at Hammon, near Marysville. The details of a complete equipment include the following induction motors: One digging motor 150 hp, variable speed; two main pumps, one 150 hp and one 40 hp; one winch motor, 20 hp, variable speed; one screen motor, 25 hp; one stacker motor, 15 hp; one small pump motor, 10 hp, and one sand pump, 75 hp. The transformers include three 75-kw, three 25-kw, and one 5-kw for lighting.

THE MORSE CHAIN COMPANY, now located at Trumansburg, N. Y., is building at Ithaca, N. Y., a plant of about five times the present capacity. The company was incorporated in 1898, no change having been made either in the name or personnel since starting, Mr. F. L. Morse being the treasurer and general manager. The plant was originally started for the manufacture of bicycle chains, but in 1901 the concern brought out the present high-speed, silent-running chain, and since that time it has had a rapidly growing business. In the line of power transmission, the Morse Company has in service chains transmitting over 75,000 hp, and is furnishing drives up to 500 hp for a single transmission.

ROBINS CONVEYING BELT.—The Robins Conveying Belt Company, New York, has received contracts for installing coal conveyors and elevators for the Haverhill Electric Company, Haverhill, Mass., for the coal handling machinery for the boiler house of the Arlington Mills Company, Lawrence, Mass., and for belt conveyors for the New Jersey Zinc Company's plant at Palmerton. It is also about to complete several large export shipments for Germany and South Africa.

BIDS FOR BURLINGTON, VT.—The following are the lowest three bids received and opened on Aug. 22 by the supervising architect, Treasury Department, Washington, D. C., for installing a conduit and electric-wiring system for the United States Post Office and Custom House at Burlington: W. W. Gale, New Haven, Conn., $1,994; Plummer Electric Company, Boston, Mass., $1,813, and John Wilkinson Company, Boston, Mass., $2,147.

BAKER AUTOMOBILE PLANT.—The Baker Motor Vehicle Company, of Cleveland, has begun work on a new plant on the West Side adjoining the plant of the American Ball Bearing Company. The plant will have 140,000 square feet of floor space. A power house will be erected and a 400 horse-power generator will be installed. All machinery will be driven by motors. It is said that the investment in the plant will reach $400,000.

POLES FOR TRANSMISSION LINE.—The Iroquois Construction Company has contracted with the Haeberle Lumber Company, Niagara Falls, for 3,000 poles for its power transmission line to Syracuse along the West Shore Railroad. The Iroquois Construction Company is connected with the Niagara, Lockport & Ontario Power Company.

BURLINGTON, WIS., MUNICIPAL PLANT.—John T. Prasel, city clerk, states that bids will be received on September 5 for the construction of a municipal lighting plant to cost about $12,000. The consulting engineer is A. T. Maltby, Fisher Building, Chicago, Ill.

TELEPHONE CABLES WANTED.—Bids will be received until Sept. 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the naval station, Guantanamo Bay, Cuba, a quantity of telephones and telephone cables. H. T. B. Harris, Paymaster-General, U. S. N.

THE WESTINGHOUSE MACHINE COMPANY, of East Pittsburg, Pa., has received the contract for a 2,000-kw turbine generator, together with all necessary equipment, to be installed in the lighting plant at Detroit, at a cost of $61,283. The engine is to be of the Parsons type.

PROPOSALS AT WOODLAND, CAL.—Sealed proposals will be received by Chas. W. Richard, city clerk, until 7.30 P. M., Sept. 18, for a franchise to construct an electric railway, as applied for by J. Reith, Jr. A certified check of 10 per cent required.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market continued to develop strength and breadth, but toward the close of the period was affected somewhat prejudicially by the apparent failure of the peace negotiations between Russia and Japan. As a matter of fact, the American market has shown some tendency on account of its inherent strength and favorable conditions of breaking away from what may be termed the international market. But it is impossible that in these days a general chill of depression in Europe should not make itself felt here, and with the possibility of a resumption of hostilities, prices in America and Europe have shown declines. There were, however, some sharp exceptions, particularly in the steam railroad field, where a corner threatened in Reading, while the buying of Erie has been very pronounced. The market was active during the week, and the dealings in electrical and allied specialties were considerable, although, almost without an exception, electrical securities were on the lower basis common to other stocks. Metropolitan Street Railway was up, however, Securities showing a gain of 1⅛ for the week and the Street Railway 2⅞. Brooklyn Rapid Transit was also up 1½. The demand for steel continues at an enormous rate, and Judge Gary, president of the United States Steel Corporation, says there is every indication of prosperity, not in the shape of a boom but steady and enduring. Such optimism is justified by the government crop report, which shows that it has been a great year for American cereals, the corn crop being estimated at 2,700,000,000 bushels and the wheat crop at over 700,000,000, while the crop of oats is estimated at 950,000,000. Needless to say, the railroads will be busy and almost everybody else. Bank clearings continue unusually large. The gross receipts for the leading railroads for the first half of August show a gain of 6 per cent over 1904, and the business failures for the week ending August 24 were only 176 against 185 in the corresponding week of last year. Following are the closing quotations of stocks after peace was agreed to by Russia and Japan, for August 29:

NEW YORK

	Aug. 22	Aug. 29		Aug. 22	Aug. 29
Allis-Chalmers Co.	17⅛	16⅝	Electric Vehicle	19	17
Allis-Chalmers Co. pfd.	57	53	Electric Vehicle pfd.	..	23
American Tel. & Cable.	90	90	General Electric	182⅛	182
American Tel. & Tel.	142⅛	139	Hudson River Tel.	..	..
American Dist. Tel.	30	31	Interborough Rap. Tran.	215⅜	213
Brooklyn Rapid Transit.	69⅛	70⅝	Metropolitan St. Ry.	129⅜	131¼
Mackay Cos.	41	40⅝	N. Y. & N. J. Tel.	..	..
Mackay Cos. pfd.	74	73⅝	Marconi Tel.	..	..
Electric Boat	30	28	Western Union Tel.	93⅝	93¾
Electric Boat pfd.	75	65	Westinghouse com.	159⅜	170
Electric Lead Reduction.	..	..	Westinghouse pfd.	..	..

BOSTON

	Aug. 22	Aug. 29		Aug. 22	Aug. 29
American Tel. & Tel	142⅛	141	Western Tel. & Tel. pfd.	..	97½
Cumberland Telephone.	117⅝	118	Mexican Telephone.	..	1¼
Edison Elec. Illum.	..	253½	New England Telephone.	133⅜	134
General Electric.	182⅝	181½	Mass. Elec. Ry.	18	18⅛
Western Tel. & Tel.	..	*18	Mass. Elec. Ry. pfd.	62	61

PHILADELPHIA

	Aug. 22	Aug. 29		Aug. 22	Aug. 29
American Railways.	..	53	Phila. Traction	..	101
Elec. Storage Battery	83	87¼	Phila. Electric	8½	9
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	28⅛	28⅜
Elec. Co. of America.	11⅜	11⅛			

CHICAGO

	Aug.22	Aug. 29		Aug. 22	Aug. 29
Chicago Subway	..	84¼	National Carbon pfd.	115	115
Chicago Edison	155	158	Metropolitan Elev. com.	24	26
Chicago City Ry.	..	193	Union Traction	..	..
Chicago Tel. Co	..	..	Union Traction pfd.	..	..
National Carbon	63	62			

* Asked.

SOUTHERN NEW ENGLAND TELEPHONE.—The progress of the Southern New England Telephone Company the past four years is shown in the following data from the annual reports of President Tyler:

	1901.	1902.	1903.	1904.
Capital	$2,760,000	$2,990,000	$3,500,000	$4,500,000
Subscribers	17,564	21,110	26,619	33,205
Gain	13%	16.8%	25%	24.7%
Capital per subscirber	$202	$179	$161	$159
Gross to capital	29%	30.7%	31%	28.6%
Expenses to gross	74.6%	75%	76%	77.1%
Total surplus to capital	2.6%	1.8%	2.3%	1.8%
Resources to capital	.5%	.9%	.5%	.6%
Maintenance to gross	30%	32.4%	36%	37.4%
Dividends	6%	6%	6%	6%
Gross earnings per subscriber.	$46.20	$43.50	$41.20	$38.70

The constant lowering of the capital investment per subscriber has lowered fixed charges per subscriber and consequently the cost of the service. For instance, the interest charge at 6% on $202, amounting to $12.12 in 1901, has been reduced to $9.44 in 1904. The premium which the stock commands has enabled the company to place such capital as needed and development has been untrammeled. Expenses have shown an increasing ratio largely due to the enlarged maintenance charge, which must be accepted as ample. The amount charged to maintenance last year was over twice the sum available for dividend payments. The usual tendency toward a lower total the public is occasionally admitted, but the increase in value of a income from each subscriber is observed. This decrease in cost to service now nearly double that in 1901 is seldom appreciated.

THE TOPEKA EDISON COMPANY.—A new corporation, the Topeka Edison Company, has been granted a charter by the Kansas State Board. This is the company, backed by the backers of the City Railway Company, which has bought out the Edison Electric Illuminating Company. The capital stock is a million and a quarter dollars, divided up into 12,500 shares of $100 each. The directors and the number of shares held by each are as follows: B. E. Sunny, 1,250; L. E. Myers, 1,250; E. E. Wilson, 1,500; George B. Caldwell, 1,750; George H. Taylor, 1,750; Frank G. Kelly, 5; Albert M. Patten, 5; C. R. Maunsell, 5; Albert H. Priddy, 5. The last four are Topeka people. Three trustees are named who hold 5,480 shares of stock in trust, but are not in the directorate of the new company. They are E. A. Potter, Jr., Theodore P. Bailey and F. R. Fenton, all of Topeka. The State received $500 for the new charter.

CONNECTICUT POWER PLANT.—The Connecticut Railway & Lighting Company has acquired ownership of the New Milford Water Power Company. The property was organized in 1893, and had outstanding capital of $1,000,000, and bonds amounting to $1,000,000. The concern built a large plant near New Milford and drained the Housatonic River near Bull's bridge and other places to supply power. It had a 30-year contract to supply power to the Connecticut Railway & Lighting Company at $130,000 a year. The power is used to operate trolleys near Waterbury and other places. The bonds of the New Milford Water Power Company are now guaranteed by the purchasers. The officers in the New Milford Water Power Company are Winthrop Bushnell, president; Louis E. Stoddard, vice-president, and Samuel C. Morehouse, secretary and treasurer, all of New Haven.

MAHONING & SHENANGO.—The plan of the merger of the Youngstown-Sharon Railway & Light Company and the Pennsylvania & Mahoning Valley Railway Company is made public in a circular issued by Sanderson & Porter, of 32 William Street, managers. The merger, the Mahoning & Shenango Railway & Light Company, is capitalized at $10,000,000, divided into $4,000,000 5 per cent cumulative preferred stock, and $6,000,000 common stock. The new company will provide for an issue of $10,000,000 ten-year 5 per cent gold bonds. Bonds amounting to $3,000,000 will be available for extensions and improvements. An extension of time until September 6 has been allowed for the deposit of certificates with the New York Trust Company. The merger is based upon a valuation of 60 per cent for the Pennsylvania & Mahoning Valley Railway Company and 40 per cent for the properties of the other concern.

TELEPHONIC REORGANIZATION.—At a meeting of the bondholders' committee of the Commercial Telephone Company of Texas, important steps were taken leading to a reorganization of the company. The committee is composed of J. H. Goeke, of Wapokoneta, O.; J. A. Quisenberry, of Danville, Ky., and Fred Bimel, of Portland, Ind., representing stockholders owning nearly $300,000 of bonds in the three States of Ohio, Indiana and Kentucky. Last month at receiver's sale in Travis County, Texas, this committee bought in all the property for $110,000. The company now has bonds outstanding and unredeemed to the amount of $442,000. The present holders have decided to organize a new company with a capital stock of $500,000 and only so much of this stock will be issued as will be necessary to take up the old bonds at par.

CENTRAL PENNSYLVANIA TRACTION.—The directors of the Central Pennsylvania Traction Company, which operates all the electric lines in Harrisburg, have authorized the construction of a new power plant to cost from $200,000 to $250,000. To meet this expense they have further authorized a 10 per cent. assessment of $5 per share on the capital stock of the company, half payments to be made November, 1905, and June, 1906. The new plant is necessitated by the large increase in the business of the company.

DIVIDENDS.—The Kansas City Light Company has declared the regular quarterly dividend of 1½ per cent. on the preferred stock, payable September 1. The directors of Whatcom County Railway & Light Company have declared a semi-annual dividend of $2 on the preferred stock, payable September 1. The Columbus, O., Citizens' Telephone Company has declared the regular quarterly dividend of 1 per cent.

IOWA TELEPHONE BONDS.—A trust deed in the amount of fifty thousand dollars has been filed by the New Sharon Electric Company to the Citizens' Bank of New Sharon as trustee, for the purpose of issuing bonds in the sum of $50,000. The property and business of the New Sharon Independent Telephone Company and the New Sharon Light & Power Company is held as security.

FORT MYER SIGNAL POST.—Bids will be received by Captain A. W. Butt, Quartermaster, U. S. A., Washington, D. C., until September 18, for constructing an addition to the electric lighting system at the Signal Corps Post, Fort Myer.

General News of the Week

The Telephone.

LITTLE ROCK, ARK.—The Southwestern Telegraph & Telephone Company is preparing to rebuild its telephone lines between this city and England.

NEWCASTLE, CAL.—An order has been issued authorizing government officials to construct a private telephone line near Tahoe.

SANTA BARBARA, CAL.—The Home Telephone Company is installing a plant for the Coleta Valley, and the cables have ben laid as far as Coleta.

SAN JOSE, CAL.—The Sunset Telephone Company will expend $60,000 next month in improving its system in this city. The central energy system will be put in.

STOCKTON, CAL.—P. Kerr Higgins, a Los Angeles capitalist, has filed an application with the city clerk for a franchise to operate a new telephone company in Stockton.

LOS ANGELES, CAL.—The Pomona Valley Home Telephone Company has issued its call-book, showing 1,000 subscribers. A new switchboard of 3,000 capacity has been ordered.

ONTARIO, CAL.—P. T. Spencer, the representative of the Home Telephone Company, has appeared before the Board of Trustees and asked that a franchise be granted his company.

RIVERSIDE, CAL.—The Corona Home Telephone & Telegraph Company has been incorporated with a capital of $25,000, of which $50 has been subscribed. Directors: A. C. Wood, J. C. Gleason, H. A. Prizer and others.

LOS ANGELES, CAL.—The Alhambra Home Telephone & Telegraph Company has been incorporated with a capital stock of $50,000, of which $5,000 has been subscribed. Directors are P. T. Spencer, G. G. Miller, L. K. Parks, F. E. Williams and E. C. Webster.

NORDHOFF, CAL.—M. W. Phillips, the local manager of the Home Telephone Company, has announced that enough subscribers have been secured to guarantee the instalment of that system in the valley, and that work would begin at once and be pushed to completion in about six weeks.

SAN DIEGO, CAL.—The Home Telephone & Telegraph Company, of San Diego, has made application to the Board of State Harbor Commissioners for the right to place a line of cables over the tide lands and through the waters of the Bay of San Diego, and to maintain the same for a period of 30 years.

SAN FRANCISCO, CAL.—The Home Telephone Company has incorporated branch concerns in Oakland, San Jose, Stockton and Fresno, the papers being filed in San Francisco, which is to be the principal place of business. The capital stock of the Oakland branch is $3,000,000, with $30,000 subscribed; Stockton, $1,500,000 capital stock, $20,000 subscribed; Fresno and San Jose, each $2,000,000 capital stock, and $30,000 subscribed. The directors of the Oakland company are William Thomas, William L. Grestle, Thomas T. Parkhurst, Jr., L. S. Ackerman, J. E. Schoenfeld and L. Webster. The other branches mentioned have the same directors with the exception of Grestle and Webster. The Home Telephone Company applied for a franchise in San Francisco some weeks ago. The formal hearing of the application by the supervisors has been postponed for a short time. Several thousand subscribers have been signed and a demonstration plant placed on exhibition at the company's offices to show the operation of the automatic system.

DANBURY, CONN.—The Rogers Telephone & Electric Company, of Danbury, has been formed with capital stock of $20,000. The incorporators are Arthur J. Baldwin, of New Jersey; N. Burton Rogers, George L. Eastman, C. B. Rogers and Annie R. Davenport, of Danbury, and Frank E. Wiske, of New York.

LOWELL, IND.—The Lowell Telephone Company, Lowell, Lake County, has been formed; capital stock, $9,000.

PENNVILLE, IND.—The Pennville telephone plant, owned by A. D. Parks, has been sub-licensed to the Bell Company.

HOPE, IND.—Application has been made to the Town Board of Hope by Lewis Blades, who resides near that village, for a franchise for a telephone system.

MARION, IND.—Oscar Barger, manager of the Converse Telephone Company, has asked the Board of Works of Marion for a franchise to operate a line from the south side of the city to Fairmount. He also asked for a franchise from the central part of the city to the west side, this line to extend to Converse.

ALTAMONT, ILL.—The Effingham County Telephone Company has been organized with a capital of $6,000. Incorporated by C. E. Munday and A. Munday.

TREYNOR, IA.—The Independent Telephone Company will locate an exchange at Treynor.

BURLINGTON, IA.—The Mississippi Valley Telephone Company will install a complete new local exchange.

SIOUX CITY, IA.—The contract for a new building has been let by the Iowa Telephone Company for $21,500.

KENNEY, IA.—All telephone lines running through Kenney are to be reconstructed with new poles and new copper wire.

LE MARS, IA.—The Plymouth County Telephone Company succeeds the local company and will make extensions and improvements.

CAMERON, TEX.—The Hanover Telephone Company is extending its lines to connect at Midland with the outside world.

ST. CLOUD, MINN.—The Minneapolis-St. Cloud-Fargo toll line of the Northwestern Telephone Company is to be rebuilt.

BROOTEN, MINN.—The Brooten Telephone Company, with a capital of $4,500, has been organized. Officers: T. O. Shelso, W. Stuart and others.

GRANITE FALLS, MINN.—An ordinance has been accepted granting to the Granite Falls Telephone Company the right to erect and maintain its poles and wires in the alleys and public ways of the city.

BISMARCK, MO.—A franchise for a telephone in this city has been granted to Dr. J. L. Eaton and Otto Ramsey.

KANSAS CITY, MO.—The Baldwin Telephone Company has been formed. Capital, $15,000. Incorporated by C. R. Baldwin, R. H. Drake.

AUGUSTA, MONT.—J. C. Furman and others seek a franchise for the construction of a telephone line from Augusta to Sun River.

BILLINGS, MONT.—E. A. Hess, of Lyons, Iowa, has received the contract for a telephone line to Buford, about 70 miles. His contract is $15,932.

GREAT FALLS, MONT.—The line to Portland and Salt Lake City will be rebuilt and two additional lines strung to Lewiston at an expense of $25,000 by the Bell Telephone Company.

NEWARK, N. J.—Still another change has been made by the Board of Works in the limited franchise it is proposed to grant to the New York & New Jersey Telephone Company for the use for a new telephone line of Newark's right of way in the land traversed by the pipe line between the Belleville reservoir and the Macopin intake. An amendment stipulating that the concern must construct for the city a telephone line similar to the one now in use, if the proposed agreement is ever canceled, was approved and incorporated in the franchise.

LANCASTER, N. Y.—The Frontier Telephone Company has applied to the Village Board for a franchise.

OSWEGO, N. Y.—The directors of the Ontario Telephone Company have approved the plans for the new telephone exchange. The plans and specifications have been sent out to prospective bidders.

SYRACUSE, N. Y.—The Independent Telephone Company, of Syracuse, controlled by Rochester capitalists, has started the work of reconstructing and improving the telephone service of the company in that city. Fifteen miles of new subway will be constructed, on which work will begin Monday. The poles and lines of the independent company will be largely extended in all the outlying sections of the city. The switchboard will be built by the Stromberg-Carlson Company. This switchboard, by the way, will, it is said, be the finest and largest ever turned out of the Rochester factory. It is built of mahogany with every new device and will cost complete $150,000. It will have an ultimate capacity service of 12,000 telephones, of which 6,000 will be connected.

NEW YORK, N. Y.—The Atlantic Telephone Company, the new independent corporation which shortly expects to be operating in Greater New York, has filed its plans in the Controller's office and at the first meeting of the Board of Estimate, which will be held on Sept. 15, the officials of the company expect a favorable decision regarding its application for a franchise. The number of exchanges proposed for Manhattan is 18; for Brooklyn 14; for Queens 9; for Richmond 4, and for the Bronx 6, with a further extension to 10 as the number of telephones increase. Where it is possible the wires of the company will be laid underground. The number of miles of wire in the different boroughs will be in Manhattan 30,000 miles; in Brooklyn 15,000 miles; in the Bronx 7,500 miles; in Queens 2,000 miles, and in Richmond 1,500 miles.

MINTO, N. D.—The Northwestern Telephone Company will put in an exchange here with rural connections.

HAMILTON, OHIO.—The bond of the Cincinnati & Suburban Bell Telephone Company in the sum of $5,000 as surety for the grant to construct conduits in the city, with John Kilgore and Volney Elston, of Cincinnati, and M. O. Burns, of Hamilton, as sureties, has been presented and approved.

EL CAMPO, TEX.—The Coast Telephone Company has been formed with a capital of $25,000. Incorporated by T. J. Poole and C. W. Robinson.

WINCHESTER, VA.—The United Telephone & Telegraph Company has been formed with a capital of $5,000. Incorporated by R. G. Park, president; S. R. Caldwell, secretary.

WAUSAU, WIS.—The Wausau Telephone Company has received materials for the construction of a new local exchange.

GRATIOT, WIS.—The Lafayette Telephone Company of this city has been formed, capital $25,000, by H. W. Burmeister and others.

MILWAUKEE, WIS.—Two independent telephone companies—the West Shore Telephone & Telegraph Company and the Milwaukee Home Telephone Company—have made application to the Common Council of Milwaukee for an ordinance permitting them to construct and operate telephone lines in that city.

SPOKANE, WASH.—The Home Telephone Company has been voted a franchise.

MONTEREY, MEX.—The Mexico Telephone Company contemplates improving its lines in Monterey.

Electric Light and Power.

TROY, ALA.—A company known as the Pea River Power Company has been incorporated to build an electric railway between Elba and Troy, Ala., and to supply light and power to the adjacent towns. The principal office of the company will be at Troy. Charles Henderson, H. D. Boyd and J. M. Garrett are the officers of the company.

LOS ANGELES, CAL.—The Yuma Electric & Water Company is reported incorporated, with a capital of $100,000 by A. A. Talmage and others.

ANAHEIM, CAL.—Clem. A. Copeland, of Los Angeles, is stated to have estimated the cost of propsed improvements to the electric light plant at $22,000 and to the water works at $18,250.

SAN FRANCISCO, CAL.—An additional 1,600-k.w. unit has just been installed at the Emeryville power station of the San Francisco, Oakland & San Jose Railway (Key Route). A General Electric direct-current generator is direct-connected to a 2,300-h.p. Hamilton-Corliss engine.

SAN LUIS OBISPO, CAL.—B. F. Thomas, Mgr. San Luis Obispo Gas & Electric Company, states that the C. C. Moore Company, of San Francisco, has secured the contract for constructing a new plant of 270-kw. capacity. A. M. Hunt, of 614 Mission St., San Francisco, is the engineer.

LOS ANGELES, CAL.—The Council has adopted a report of the Lighting Committee in which it is recommended that the city clerk ask bids for municipal lighting under the following terms: 1 year contract not to exceed 2,000 lights, 3 year contract not to exceed 2,500 lights and 5 year not to exceed 3,000 lights.

SAN FRANCISCO, CAL.—The California Gas & Electric Company has completed the installation of two additional 5,000-k.w., 3-phase generating units at its Electra power station. This addition to the three generators already in operation gives the Standard Electric transmission line a large capacity.

SAN FRANCISCO, CAL.—The California Powder Works now has in successful operation at its new general power house at Hercules a 400-kw, three-phase Westinghouse-Parsons turbo-generator. It is the first installation of the kind in this vicinity. A. M. Hunt acted as consulting engineer on the improvements at the powder plant.

SAN FRANCISCO, CAL.—The Eel River Power & Irrigation Company is building the pole line on its 22-mile transmission from Potter Valley to Ukiah. It is probable that a transmission line will be built to San Francisco, a distance of 130 miles, as the market for power near the plant is limited. The machinery ordered includes two 2,000-kw, three-phase generators and two Victor turbine water wheels.

SAN FRANCISCO, CAL.—It is reported that the Tuolumne Electric Company, which is constructing a water-power electric plant near Tuolumne, Cal., has arranged to sell power to operate the projected Kemp, Van Ee electric road from Santa Cruz to Hollister and to the new cement works to be erected in the San Juan Valley. H. Hersey is president and C. W. Quilty manager of the electric power company. The machinery contracted for includes two 600-kw. Bullock, three-phase generators and a 1,200-hp. Platt Iron Works wheel operating under 425-foot head.

NORWICH, CONN.—The Uncas Power Company, of Norwich, has been incorporated with a capital of $1,000,000.

STERLING, CONN.—The Sterling Power Company has been incorporated with a capital of $500,000, and will distribute electric light and power to the towns of Sterling, Plainfield, Brooklyn and Killingly.

NEW HARTFORD, CONN.—The Northern Connecticut Power Company, of New Hartford, has been incorporated to operate in Litchfield, Hartford and Tolland Counties under certain restrictions, and is to develop water power on the Farmington River.

PACKERSVILLE, CONN.—Negotiations are now in progress for the purchase of the Packer power privilege here in behalf, it is understood, of the New York, New Haven & Hartford railroad, which wishes to erect an electric power station for the eastern Connecticut branch of the Consolidated Railway Company and to furnish lighting for Wauregan, Moosup, Plainfield and other nearby towns.

RIDGEFIELD, CONN.—There is every prospect that Ridgefield will have a new electric plant in the immediate future. A meeting of the stockholders of the Ridgefield Electric Company has been held at which the following directors of the company were elected: Henry B. Anderson, John A. Mitchell, George Pratt Ingersoll, George G. Haven, Jr., Dr. R. W. Lowe, Albert H. Wiggins; secretary, Harvey P. Bissell. Mr. Kirk has been made general superintendent and assistant secretary of the Electric Company.

ST. PETERSBURG, FLA.—The St. Petersburg Investment Company, which owns the electric light plant and street railway, contemplates moving the plant and reconstructing it with the addition of a 350-hp. boiler and two 250-hp. engines.

SAVANNAH, GA.—The City Council on Aug. 18 passed the ordinance granting a franchise to the Savannah Lighting Company.

JASONVILLE, IND.—The Jasonville Electric Company will build an electric light plant in that city.

GENEVA, IND.—W. R. Thurston, of Bern, is reported to have petitioned for a franchise to construct a power plant at Geneva.

MICHIGAN CITY, IND.—Estimates are being prepared for remodeling the electric light plant of the Indiana State Prison.

VAN BUREN, IND.—The Huntington Light & Fuel Company, of Huntington, Ind. (F. D. Townsend, Supt.) has petitioned the City Council for a franchise for the erection and operation of an electric light plant in this city.

PEKIN, ILL.—The Tremont electric light and power plant will be rebuilt.

BELLEVILLE, ILL.—The City Council has appointed engineers to prepare estimates of the proposed municipal electric lighting plant.

FREEBURG, ILL.—Chas. Kessler, village clerk, states that the proposed municipal electric light plant will cost about $9,000. No engineer has been selected yet.

BLOOMINGTON, ILL.—A syndicate of Detroit capitalists, headed by Emanuel T. Beyer, has purchased the Union Gas Light & Electric Company for $400,000, the amount of the capital stock.

VANDALIA ILL.—The Vandalia Light & Fuel Company recently sold its electric light plant to the city of Vandalia for $18,000. A number of taxpayers have since filed suit to enjoin the consummation of the sale on the grounds that the city is already indebted beyond the constitutional limit and has no right to engage in the business of selling light.

GENEVA, IND.—The town council has granted W. R. Thurston a franchise for an electric light plant.

MORRISON, IOWA.—The Morrison Electric Light Company has awarded the contract to erect a gas plant in Morrison to Frank S. Moses Company, of Trenton, N. J., at about $50,000.

HERINGTON, KAN.—Chas. F. Custafson, of Topeka, it is stated, has secured a franchise to furnish water, electric light and power to Herrington.

SOMERSET, KY.—W. G. Hunter, of Somerset, has received a franchise for an electric light plant. T. R. Griffin Mayor.

NEWPORT, KY.—An election is to be held Nov. 7th to vote on the proposition to issue $50,000 bonds for an electric light plant. Peter J. Krebs is city clerk.

PITTSFIELD, MASS.—The Eaton-Hurlbut Paper Company is to erect a new power plant in South Church Street. The concern has outgrown the present plant. The new plant will be of brick and will cost about $15,000.

BOSTON, MASS.—An attempt has been recently made by parties in Boston to purchase the controlling interest in the Fall River Electric Light Company. It is understood that offers of over $175 a share have been made for stock of the Fall River Electric Light Company, and the rights to subscribe for the new stock are variously quoted from $10 to $15 a right.

UPTON, MASS.—The Upton Electric Company has sent a letter to the local authorities, declining to accept the conditions whereby the use of Upton's streets could be secured for the carrying on of electric lighting service. The Selectmen gave the company privileges of location provided the company would light Upton town hall free of charge while the contract was in force.

HOLYOKE, MASS.—The contract for the new power plant of the Holyoke Water Power Company has been awarded to Casper Ranger for about $150,000. The contract includes the building, the canal walls of granite, head gates of iron, and it is estimated about 1,000,000 brick will be required in addition to the other material. The house will be located near the Norman paper mill, and the excavations have been made. Mr. Ranger has already begun construction work.

LEOMINSTER, MASS.—Arrangements for the control of the Leominster Electric Light & Power Company by the Massachusetts Electric Companies are completed. All the stock has been subscribed, and the directors have elected E. S. Clarke, of Boston as president and manager. The Leominster Company is to retain its name, and the capitalization of $50,000 is to be the same.

WALTHAM, MASS.—A new power house is in process of construction at Waltham. The building will be of concrete and steel construction, 153 feet in length, 100 feet wide and 35 feet high, with a boiler room at the rear at a lower level. When the building is completed, three generator engines, now being built, will be installed; power will be supplied for electric lighting and for the street car service.

GRAND RAPIDS, MICH.—The Grand Rapids Edison Company is preparing to install a steam turbine.

ROSE CITY, MICH.—Jas. Monaghan and Frank G. Bell have secured a franchise to install a commercial lighting plant.

GRASS LAKE, MICH.—The lighting proposition has been carried in this city by 23 majority. Work will be commenced at once on the new plant.

GRAND RAPIDS, MICH.—The Grand Rapids Electric Light Company has been incorporated with a capital of $15,000. Incorporators: Walter C. Winchester, W. C. Miller and E. A. Stowe.

PONTIAC, MICH.—Engineers McKean, Ball & Co., of Chicago, Ill., write that the general contract for constructing the plant of the Clinton River Power Company has already been let, but wire and supplies and arc lamps are yet to be purchased.

FLORENCE, MICH.—A. E. Edmonds and Rhinelander capitalists, it is reported, will construct a power plant to supply the cities of Florence and Crystal Falls with light, and operate an interurban line from Iron Mountain to Spread Eagle Lake.

HART, MICH.—J. N. Cotton, of Hart, Pres. Pere Marquette Light & Power Company, writes that Harry McDaugh, of Dayton, O., has prepared plans and specifications for improvements to this plant, which will be made sometime within a year. The probable cost of the proposed work is $75,000.

CHEBOYGAN, MICH.—Dr. A. M. Gerow is promoting an enterprise to dam Pigeon River. He has the necessary flowage rights. The entire cost of the investment will be $350,000, the current delivered in Cheboygan, the transformer station included. The plant is to generate 8,000 horse-power. The head will be 75 feet.

MOUNT IRON, MINN.—This village is reported to have voted to install an electric light plant.

MINNEAPOLIS, MINN.—Announcement is made of the purchase of the property known as Big Island, in Lake Minnetonka, twenty miles from Minne-

apolis, by the Twin City Rapid Transit Company. The property will probably be rechristened Coney Island, and the company will construct on a smaller scale an amusement center on the plan of the big New York resort. Steamers will be operated on the lake in connection with the new suburban line of the company now nearing completion.

WAUSAW, MO.—The proposition to issue $6,000 electric light bonds was carried at the recent election.

ST. CHARLES, MO.—The city electric light plant is receiving a complete overhauling. The circuits are also being repaired. The question of moving the plant and consolidating it with the city water work plant is still in deadlock in the Council.

GOLDFIELD, NEV.—The Bishop-Nevada Electric Power & Lighting Company has been incorporated with a capital of $1,000,000, for the purpose of constructing an electric plant on the Owens River, near the town of Bishop, to transmit power to Tonopah, Goldfield, and Bullfrog. D. Jones, of the J. Jones Exploration Company may be able to give further information.

ROCHESTER, N. H.—The Board of Managers of the Alton Bay Campmeeting Association is considering the matter of installing an electric light plant on the campmeeting grounds.

BERLIN, N. H.—E. A. Noyes, of Portland, trustee and treasurer of the Berlin Electric Light Company, has closed a deal with W. K. Aston, of Shelburne, for water power privileges on the Androscoggin at the so-called lead mine bridge. The contract has been given to Ward Brothers, of Berlin, for the construction of a power house and dam estimated to cost from $75,000 to $100,000. There will be a concrete fireproof building 110 feet long and 50 feet wide.

ATLANTIC CITY, N. J.—An ordinance has passed first reading in the City Council granting a franchise to the Atlantic City & Suburban Electric Company.

PERTH AMBOY, N. J.—The City Council has granted a franchise to the Citizens' Electric Light & Power Company. The company will probably begin work on its plant at once. Engineers, Runyan & Carey, 122 Market Street, Newark.

SILVER CITY, N. M.—The City Council has granted a 50-year electric light franchise to Geo. T. Schmelzel and associates.

JARILLA, N. M.—R. G. Mullen represents a company which proposes erecting power plants along the Sacramento River for a mining camp at Jarillo.

SILVER CITY, N. M.—Geo. T. Schmelzel says that the proposed electric light plant will cost $9,000. His address is Hotel Brevoort, Chicago, Ill., for 10 days after Sept. 1st.

ALBUQUERQUE, N. M.—The Union Gas & Traction Company has been incorporated with a capital of $500,000 for the purpose of constructing and operating gas, oil, electric and water works plants and systems; to operate a system of pipe lines, wires, etc., for the transportation of gas, oil, electricity and water; to own and develop clay, sand, cement and other lands and properties, to operate steam, electric and cable street cars or traction lines. Incorporators: C. H. Pattison, Kansas City, Mo.; W. L. Pattison, Gardner, Kan.; J. F. Luthy, Albuquerque, N. M., and others. The principal place of business is to be Albuquerque, N. M.

CAMDEN, N. Y.—The contract for constructing a power house for the municipal electric light plant has been awarded to J. A. Raymond. The building must be ready to receive machinery Oct. 1.

ROCHESTER, N. Y.—The Niagara Falls Electrical Transmission Company, of Niagara Falls, N. Y., has applied to Mayor Cutler for permission to erect poles and wires and to construct conduits in the streets, alleys and public places of the city and to transmit and sell electric power and light.

STILLWATER, N. Y.—Flood & Sherrill, of Sandy Hill, have secured the contract to construct a concrete dam across the Hudson River at Stillwater, at a cost of about $16,000. About 600 to 800 cu. yds. of rock will be excavated. The dam is to provide power for the Hudson Valley Ry. and to the mills.

LITTLE FALLS, N. Y.—The P. B. McCaghey Company has been organized by W. J. Berrigan, of Little Falls; J. E. McCaghey, of Sandy Hill, and others. The company has secured contracts from the Paul Smith's Hotel Company to construct two electrical power plants, one at Union Falls, Clinton County, and the other at Franklin Falls, Franklin County.

ROCHESTER, N. Y.—It is stated authoritatively that the Niagara Falls Electrical Transmission Company which has asked for a franchise in Rochester, has no connection with the Niagara, Lockport & Ontario Power Company and that the latter company does not contemplate seeking franchises in Rochester and Syracuse. The Niagara Falls Electric Transmission Company has as its president Mr. Frederick Nicholls, of Toronto. Its vice-president is Frank A. Dudley, of Niagara Falls.

READING, OHIO.—Bids will be received Oct. 15 by G. Hornung, 612 Johnston Building, Cincinnati, for a new electric light plant for Reading, to cost about $30,000.

TOLEDO, OHIO.—The question of holding an election to vote on the issuing of $500,000 bonds for a city lighting plant is under consideration by the City Council.

TOLEDO, O.—Chas. S. Ashley, president of the Central Heating & Lighting Company, has announced that extensive improvements are to be made in the company's lighting plant in the Meredith Building.

TOLEDO, OHIO.—Citizens will be asked to vote, at the fall election, on the installation of a municipal electric light plant. An estimate, prepared by F. I. Consaul, chief engineer of the Board of Public Service, places the cost at about $470,000.

ZANESVILLE, OHIO.—The H. H. Sturtevant Company has had plans made for a large electric power plant which will in the near future be added to the equipment of its large department store. The contract for the erection of the new power plant has not been let, but all other arrangements and plans have been completed.

TOLEDO, OHIO.—The principal features of the franchise asked by the Central and East Side heating and lighting companies are: Companies to give city bond, Central $25,000, East Side $15,000, to insure good faith and completion of plans in 18 months; rate for lighting to be 9 cents per kw-hour; city has right to use all of either company's poles or conduits without charge; city reserves right to change prices for heating every five years, lighting every 10 years; franchise to run 25 years; the Board of Public Service is vested with authority to compel either company to extend its service to any reasonable location.

MIAMI, OHIO.—The Maumee Valley Electric Company is making preparations for the extension of its operations on both sides of the river between the city line and Maumee and Perrysburg, including the two named towns. The company operates the power plant near Miami, that was originally used to furnish electricity for the Maumee Valley Belt line. It is owned by the Detwilers and George G. Metzger. A franchise will be asked from the councils of Maumee and Perrysburg and an effort made to light every house on both sides of the river between Toledo and the two towns up the Maumee. Wires are now being strung to many summer homes just beyond the city limits.

DRAIN, ORE.—The Skelley Lumber Company is about to apply to the Town Council for a water and light franchise.

NEW CASTLE, PA.—Rights of way have practically all been secured through this county for the new interurban electric railway, to be built from Pittsburg to New Castle by the Pennsylvania Motor Power Company, recently organized by Pittsburg capitalists.

CAMDEN, PA.—The Wyoming Gas & Electric Company has been formed to operate and maintain gas and electric lighting plants; capital $15,000. Incorporators: John A. MacPeak and others.

YORK, PA.—Sanderson & Potter, of New York, N. Y., are reported to have secured the contract for constructing a dam 32 ft. high, to contain about 375,000 cu. yds. concrete masonry, on Susquehanna River, for the McCalls Ferry Power Co.

CONNELLSVILLE, PA.—A deal just completed makes a change in the ownership and management of the Interstate Electric Company of Connellsville. On account of a press of duties as superintendent of transportation of the West Penn Railways Company, J. W. Brown, who organized the company, and Frank Zimmerman, have sold their stock to J. M. Fisher and Charles O. Moser, who were electricians for the company.

MOOSUP, R. I.—The Consolidated Railroad Company is proposing to buy the Packer power privilege at the Quinebaug Bridge, a few miles west of Moosup, with a view to building an electric power plant to furnish light and power for the tramway, and also for the villages of Plainfield, Wauregan, Central Village and Moosup.

PLUMA, S. D.—Phillips & Bartlett, of Deadwood, are stated to have secured the contract for erecting a power house at Pluma for the Consolidated Power & Light Co.; probable cost, $20,000.

SIOUX FALLS, S. D.—The Queen City Electric Light & Power Company has been incorporated at Pierre with a capital of $300,000. Incorporators: H. J. Hanford, Chicago, Ill.; P. Curtis, Norwalk, O.; W. G. Mack, of Sioux Falls, and others.

OLIVER SPRINGS, TENN.—Fred. C. Sinckneicht is reported to have decided to construct an electric light plant at this place, and is in the market for an engine.

BRISTOL, TENN.—Following a meeting of the directors of the Bristol Gas & Electric Company, it was announced that the General Electric Company has purchased a large interest in the properties and franchises of the local company which owns all the gas, electric and street railways in this city and Bristol, Va.

VERNAL, UTAH.—The City Council has granted a franchise to G. H. Seth for an electric light, heat and power plant.

RICHFIELD, UTAH.—A. J. Paulson, of Richfield, has filed with the state engineer, at Salt Lake City, an application for a water right on Sevier River. It is proposed to install a power plant capable of developing 450 hp.

OGDEN, UTAH.—L. B. Spencer, of Ogden, has filed with the state engineer, at Salt Lake City, an application for a water right on Ogden River. He intends to construct a power plant to furnish both power and light in Ogden.

SALT LAKE CITY, UTAH.—J. H. Bigger and J. E. Hill have applied for permission to develop power for electrical purposes from American Fork Creek. They propose developing 950 hp for electric lighting and for working machinery in the American Fork mining district.

READSBORO, VT.—Plans are under way for the erection of an electrical power plant on the Deerfield River, north of the east portal of the tunnel. A charter for the new company has been secured from the State of Vermont, under the name of the Deerfield River Power Plant Company. Among those interested in the project are W. S. Morton, of Hartford, Conn.; James H. Roraback, of Canaan, Conn., and Faxon Bowen, of Readsboro, Vt. The plant will be located near Readsboro in Vermont.

RUTLAND, VT.—Receiver Fox of the Rutland Street Railway Company and the Chittenden Power Company, of this city, whose securities were sold by Receiver Douglas Robinson of the Merchants' Trust Company, has explained that the sale was a matter of routine, to clear the local companies in-

volved from their entanglement in the affairs of the Merchants' Trust Company, which held securities aggregating $425,000, given by the Rutland concerns in connection with bond issues. The sale will make no change in the management. It is understood that work on the Chittenden Power Company, which is unfinished, will be pushed.

EVERETT, WASH.—The Mayor has been directed by the City Council to appoint a committee to investigate the possibility of establishing a municipal electric light plant.

ARLINGTON, WASH.—Thos. Moran is reported to have secured a franchise for a light and water system, the power to be developed from the falls of Jim Creek.

TACOMA, WASH.—The City Council Committee on fire and water has recommended that the arc circuit, which in the report of the City Engineer is estimated to cost $5,000, be installed immediately.

SUNNYSIDE, WASH.—The question of constructing water works and an electric light plant is reported under consideration here. The probable cost is $15,000.

REARDAN, WASH.—The Reardan Light & Power Company, it is reported, has been incorporated with a capital of $5,000 to engage in the light and power business. Incorporators: Frank Bradley, John Fields, John Rayman and others.

ALMOND, WIS.—The Almond Milling Company is stated to have asked for a franchise for an electric light plant.

PHILLIPS, WIS.—The Phillips Light, Water, Heat & Power Company petitioned for a franchise.

WESTFIELD, WIS.—The citizens are reported to have voted in favor of establishing an electric light plant.

LITTLE CHUTE, WIS.—The Kaukauha Electric Light Company (W. H. Nelson, secretary) has applied for an electric light franchise here.

BURLINGTON, WIS.—At a special election in this city the proposal to vote $12,000 for a municipal electric lighting plant was carried by a vote of 193 to 188.

MILWAUKEE, WIS.—The County Trustees are stated to have appointed the Milwaukee Engineering Company to prepare estimates for a new electric wiring system at the county hospital; and to be discussing the question of providing for a central heating, lighting and power plant, as well as for extending the city water mains to the Wauwatosa institutions.

PEMBROKE, ONT.—The Pembroke Light, Heat & Power Company has been formed to acquire water power on the Black River, for the purpose of adding to the present electric light system.

NAPANEE, ONT.—W. A. Grange, town clerk, states that plans and specifications have been prepared by R. S. Kelsch, New York Life Bldg., Montreal, Que., for the proposed municipal electric light plant; probable cost, $35,000.

CARACAS, VENEZUELA.—The Caracas Gas & Electric Light Company has been declared bankrupt. The municipal government having sued the Caracas Gas & Electric Light Company for breach of contract, the company replied by sending notice that it would not light the city. The government immediately took possession of the entire plant of the company.

The Electric Railway.

LITTLE ROCK, ARK.—The preliminary survey for the Little Rock & Hot Springs Electric Railroad has been filed. The line will run westerly from Little Rock.

SAN FRANCISCO, CAL.—The Ocean Shore Railway Company, A. D. Bowen, manager, will open bids September 1 for the construction of its standard-gauge electric road, 82 miles in length, connecting San Francisco and Santa Cruz. It has been decided to double-track the line for the entire distance.

OAKLAND, CAL.—It is announced that Walter E. Dean, J. Downey Harvey, Burke Corbet and their associates in the Ocean Shore Railway, have decided to make the proposed electric line to Santa Cruz a double-track road instead of a single-track line, as originally planned. This change in the company's plans will involve an increase in the capital stock from $3,000,000 to $5,000,000, and the creation of a bonded indebtedness of $5,000,000.

YREKA, CAL.—An option on a majority of the stock of the Yreka Railroad has been secured by Alex. J. Rosborough. The road at present connects Montague on the S. P. R. R., with Yreka, but it is the intention of those now gaining control to extend to Fort Jones and Etna, in Scott's Valley, a distance of about 40 miles. It is reported that the road will be changed to an electric line by the new owners.

SONOMA, CAL.—The Sonoma Valley Company has been incorporated to construct an electric railway from Sonoma to Glen Ellen, a distance of six miles, and to furnish electric light and power for all persons en route. The electric road will touch at El Verano, Eldredge, Agua Caliente Springs and Boyles' Hot Springs. The incorporators are said to have already obtained options on the Sonoma electric lighting plant and on the franchise granted to Weber & Schocken in the city of Sonoma. They expect to apply to the Board of Supervisors at their September meeting for a franchise over the county's domain between the points named. Work is expected to begin in the near future.

WAYCROSS, GA.—A. Sessons, C. M. Sweat, and others, have made application to the City Council for a franchise to operate a street car line, to be known as the Waycross Street & Suburban Railway Company.

FORT WAYNE, IND.—The Fort Wayne & South Bend Traction Company has just completed the survey of its line from South Bend to Fort Wayne, and expects to have a large force on the South Bend end of the line in 30 days.

EAST ST. LOUIS, ILL.—The Ozark Mountain Electric Railway Company is petitioning the City Council of East St. Louis for a franchise to construct, operate and maintain an electric railway on Market Ave., 27th and 4th Sts., to Belleville. The right of way is said to have been secured. E. W. Hartman, of East St. Louis, is president of the company.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed by the St. Louis, Vandalia, Terre Haute & Eastern Traction Company, with a capital stock of $1,000,000. Its principal office will be in East St. Louis. The object is to construct a trolley line from East St. Louis to Terre Haute, Ind., with branches. The directors are Peter Chase, Decatur; Charles W. Mills, Chicago; Louis Bissell, Effingham; Henry J. Wanner and William P. Baldwin, Chicago.

CLAREMORE, I. T.—A charter for an electric railway has been granted by the Council to T. S. Chambers, of Blackwell, Okla. The proposed electric railway will connect the business and residence portions of Claremore with the radium springs, and extend to the lakes, six miles south of here.

HOPKINSVILLE, KY.—Geo. V. Green, a member of the State Prison Commission, announces that the commission is preparing to construct an electric railway from Eddyville to the branch penitentiary, about a mile and a half from town and the railroad depot. The work of building the road will be commenced and pushed to completion as rapidly as possible.

PARIS, KY.—The Paris-Carlisle-Maysville Traction Company, of which ex-Congressman James N. Kehoe, of Maysville, is president, has been granted a franchise to enter Paris by a route and upon streets to be designated by the City Council. The work of construction is to begin within 18 months and to be finished in three years. The Fiscal Court has granted the company a franchise from Paris to the Nicholas county line. The Traction Company and the county will co-operate in the building of an iron bridge over Stone Creek at the foot of Main St., 60 feet wide.

PARSONS, KAN.—The Pittsburg Electric Railway Company has secured a loan of $600,000 from the Lincoln Trust Company, of New York, for the purpose of financing the extension from Pittsburg to Columbus.

BALTIMORE, MD.—The town council of Takoma Park, Md., has adopted an ordinance granting the right of way to the Baltimore & Washington Transit Company of the State of Maryland to construct and operate a single-track railway.

HAGERSTOWN, MD.—The Hagerstown Street Railway Company has begun work on its extension to Waynecastle. The road will be a little more than nine miles long, four of which are in Pennsylvania. It will run through private lands, the company having purchased rights of way for the entire distance through farms. A substation will be erected at Middleburg.

BALTIMORE, MD.—The Baltimore Terminal Company has been organized as a subsidary company of the Washington, Baltimore & Annapolis Railway, to construct a terminal in the City of Baltimore to accommodate the cars of the interurban company. An ordinance is already pending before the Council of Baltimore to permit the parent company to operate its interurban cars in the city, having Baltimore Street and Hopkins Place as the site of the terminal, within two blocks of the shopping district. George T. Bishop, president of the company, states that it will spend $5,000,000 in improvements at that point and proposes to start with the work at once. Cars will be equipped with four 125-hp motors capable of 70 m.p.h. The tracks will be laid on private right of way except in the two cities, and the line will be double track.

AUGUSTA, ME.—The articles of association of the Norway & Western Railway Company have been approved by the Railroad Commissioners. The company will build an electric railway through the towns of Norway, Waterford, Stoneham and Albany, with a branch at South Waterford.

KALAMAZOO, MICH.—By the closing of one of the most remarkable railroad deals in the history of the State of Michigan, the Kalamazoo, Lake Shore & Chicago Traction Company has come into possession of the Michigan Central Railroad track and right of way for a distance of 16 miles between Kalamazoo and Mattawan, completing the right of way for a line between Kalamazoo and South Haven. The section of track sold by the Michigan Central was not adapted to the giving of a perfect steam road service. It is winding and the grade is heavy. The work of laying a new line of tracks was begun two years ago and is now completed. With the taking over of this track by the interurban company the prospects are bright for the opening of traffic between Kalamazoo and Lawton this fall. The power house will be located at South Haven. The officers and stockholders of the company are: President, S. J. Dunkley; vice-president, George E. Bardeen; treasurer, W. R. Beebe.

KANSAS CITY, MO.—Jacques A. Haskins, of Haskins City, has been awarded the contract for constructing the Kansas City-Olathe Electric Railway, financed by W. B. Strang. The road will enter the city by way of the Metropolitan's Westport line.

ELIZABETH, N. J.—Work has begun on a trolley line between Elizabeth and Middletown by the New York & Philadelphia Company. The road is being constructed under a railroad charter, and it has a 100-foot wide right of way from Trenton to Elizabeth, N. J. Ninety and 100-pound rails are to be used in the construction, and double tracks will be laid the entire distance. Plans have been made, it is said, for an addition to a power house between New Brunswick and Trenton, which is already constructed. The officers are: W. A. Stearns, president; I. H. Silverman, treasurer, and E. H. Harrington, general manager. Inquiries can be addressed to the company's Elizabeth, N. J., offices.

ALBUQUERQUE, N. M.—The City Council of Las Vegas has granted to

W. A. Buddecke an electric railway and lighting franchise for a term of 50 years. The franchise contains a contract for the lighting of the city.

ALBUQUERQUE, N. M.—The Union Gas & Traction Company has been incorporated with a capital stock of $500,000, to engage in the construction and management of gas, electric light and street railway plants. The incorporators are: C. H. Pattison and N. D. Pattison, of Kansas City; W. L. Pattison, of Gardner, Kan.; J. F. Luthy, of Albuquerque.

PORTAGE, N. Y.—The Genesee River Railroad Company has been incorporated under the laws of the State of New York, to build and operate an electric road 30 miles long, from Portage, Livingston County, to Cuba, Allegheny County. The capital is $350,000. Among the directors are F. B. Underwood, Francis L. Stetson, George F. Brownell, Charles Steele and Granville A. Richardson. This will be a cut-off of the Erie Railroad.

TOLEDO, OHIO.—The seven interurban railways entering this city, and the Toledo Railways & Light Company have joined hands in a project for a new union depot, to be erected on the local railway company's property.

STEUBENVILLE, OHIO.—The Steubenville, Mingo & Ohio Valley Traction Company has been absorbed by the Steubenville & Wheeling Traction Company, of which A. M. Snyder, of Cleveland, is president, and A. A. McCaslin, of Cleveland, secretary. The new company has filed a mortgage for $650,000 on the property given to the Dollar Savings & Trust Company, of Wheeling. The company will extend the line.

SHAWNEE, OKLA.—The City Council has granted Willis E. Fertig and associates a franchise to build and operate a street railway in this city. It is understood that Fertig is to purchase the Shawnee Traction Company.

PAWNEE, OKLA.—The Interurban Traction Company, of Oklahoma City, is putting an engineering corps in the field to locate an electric railway to Norman. The contract has been let for the grading of the line from the corporated city limits of Oklahoma City to the south border line of Capital Hill.

WILKINSBURG, PA.—The Council of this city has asked $10,000 for a street railway franchise from the Turtle Creek & East Pittsburg Street Railway.

YORK, PA.—A survey will be made this fall for a trolley line from Red Lion to York Furnace, Brougueville and Airville, a distance of over 15 miles. Sheriff S. M. Manifold is in charge of the survey.

SCRANTON, PA.—A charter has been issued to the Scranton & West Side Street Railway Company, with a capital stock of $24,000, to build 3½ miles of road in Scranton. Ezra H. Ripple, is president.

PITTSBURG, PA.—The Pittsburg & Cross Creek Railroad Company has been incorporated with a capital stock of $70,000, to build seven miles of road in Washington County. The president of the new company is N. T. Sanford, Pittsburg.

BROWNVILLE, PA.—The Uniontown, Brownville & West Side Railway, building 16 miles of line to connect Brownsville, Bridgeport, Uniontown and other points, is in the market for cars and overhead material. Mr. J. P. Byrne, of Scottsdale, Pa., is president of the company.

ALLENTOWN, PA.—The directors of the Lehigh Valley Traction Company have made contracts for equipment that will call for an expenditure of $1,100,000. The old power house will be abandoned on both the Lehigh Valley and Philadelphia lines and replaced by a central high-tension plant at Allentown.

PITTSBURG, PA.—Private right of way has practically been secured for the Shenango Street Company, 65 miles long, connecting New Castle, Sharon and other Shenango Valley points with Conneaut Lake, Meadville and Cambridge Springs, and the connecting links, also between Pittsburg and Erie, a distance of 150 miles. This line is independent of the Shenango & Mahoning Valley consolidation and will be built by Cleveland and Pittsburg capital.

PIERRE, S. D.—Articles of incorporation have been filed for the Sioux Falls Interurban Electric Railway Company, to construct a line from Sioux Falls to Salem, a distance of 40 miles. The company is capitalized at $500,000. The incorporators are: R. F. Brown, J. P. Bleeg, Eugene Saenger, G. W. Abbott and Geo. W. Pettigrew, all residents of Sioux Falls.

NASHVILLE, TENN.—The Nashville Interurban Railway Company, which recently purchased the rights and franchises of the Nashville & Columbia Electric Railway Company and the Nashville & Gallatin Electric Railway Company, will at once begin the construction of a line from Nashville to Franklin, a distance of 21 miles. Chas. S. Brown, of Nashville, is consulting engineer for the company.

CORSICANA, TEX.—J. V. Watkins, who is promoting the proposed interurban electric railway from Corsicana to Fairfield, has appeared before the Board of Trade of Palestine with the proposition to extend the line on through Fairfield. The proposition was favorably received.

MORGANTOWN, W. VA.—The Sabraton Railway Company has been granted a franchise for the construction of an electric railway here.

KENOSHA, WIS.—A. C. Frost, president of the Chicago & Milwaukee Electric Railway Company, and Bion J. Arnold, president of the Kenosha Electric Railway Company, were in Kenosha recently completing arrangements for the building of the Chicago & Milwaukee into Kenosha.

TACOMA, WASH.—Articles of incorporation have been filed by the promoters of the electric railway between Tacoma and Puyallup. The new company is to be known as the Puyallup Valley Railway Company. The capital stock is $250,000. Nine trustees will control the affairs of the company and those who will be in charge until the first election, Jan. 3, 1906, are Fred. J. Chamberlain, W. D. Cotter, W. H. Elvins, J. E. Stevenson, John Millis, W. R. Scott, L. A. Chamberlain and Charles Fulmer, all of Puyallup.

THREE RIVERS, QUE.—A special meeting of the City Council was held on Aug. 25 for the purpose of considering a grant to the new electric railway to Shawinigan Falls. It was decided to pay $3,000 per mile, making $66,000 to Shawinigan Falls, with an additional $18,000 for continuation to Grand Mere, all to be paid when the road is completed.

New Industrial Companies.

THE NORTON RAILWAY SUPPLY COMPANY, of New York, has been formed; capital $600. Directors: Benjamin Norton, T. H. Campion, Troy; J. L. Scott, Saratoga Springs.

THE EXCELLO ARC LAMP COMPANY, of New York, has been formed; capital, $10,000. Directors: R. H. Ludlow, Hermann Olms, R. L. Pritchard, New York.

THE ADJUSTAPHONE COMPANY has been organized under the laws of New Jersey at Camden; capital, $250,000. Incorporators: Robert E. Hill, William S. Pearne, Frank B. Pearne.

THE ELECTRIC CONSTRUCTION & SUPPLY COMPANY, of Oswego, N. Y., has been formed. The incorporators are John C. Knight, John C. Snyder, of this city; W. S. Nichols, E. R. Scott and F. A. Mott, of Syracuse.

THE PENNSYL MANUFACTURING COMPANY, Chicago, has been incorporated to manufacture electrical appliances. Foree Bain, 947 Monadnock Block; George T. May, Jr., and M. F. Allen are the incorporators.

THE PEARSON TYPO-BAR COMPANY has been organzed at Portland, for the purpose of carrying on an electrical and mechanical business, with $10,000 capital stock, of which nothing is paid in. Officers: President, Millard W. Baldwin, of Portland; treasurer, Jas. J. Hernan, of Portland.

Educational.

WESTERN UNIVERSITY OF PENNSYLVANIA.—The University issued recently an illustrated booklet setting forth in an attractive manner the reasons why a young man should be given a college education, why Pittsburg is the natural and ideal home for a great university and why the Western University of Pennsylvania is admirably situated and equipped for carrying on educational work. The University offers four general educational courses: (1) The Classical; (2) the Latin-Scientific; (3) the course in General Science, and (4) the course in Chemistry. There are four Engineering courses: civil, mechanical, electrical and mining. There are also Departments of Law, Medicine, Pharmacy and Dentistry. It is stated that in the near future a new location will be purchased in the eastern part of Pittsburg, on which will be brought together all the departments of the University.

UNIVERSITY OF WISCONSIN.—The University has just issued a bulletin describing the course in Chemical Engineering which will be offered for the first time when the University opens on Sept. 25, 1905. It is the purpose of the chemical engineering course to train students thoroughly in the fundamental principles of both chemistry and engineering. It is held that a chemical engineer should have as thorough a founding in the principles of engineering as a mechanical, civil or electrical engineer should have, and the course is arranged to accord with that belief. In addition to this, he should have an equally thorough founding in the principles of chemistry. To provide satisfactorily for such training within four years seems impossible, and therefore a five-year course is offered. If a student so desires he may at the end of four years receive the degree of Bachelor of Science in this course; if, however, he completes the fifth year, he will receive the degree of Chemical Engineer.

Obituary.

MR. G. C. RUMBOLD.—George C. Rumbold, who, it is said, superintended the construction of the Great Eastern, which laid the Atlantic cable, died on August 20 at East Orange, N. J. He was born in London 82 years ago. He superintended the building of many ships for the British Navy. In 1868, the Civil War having demonstrated the fact that wooden vessels were no longer available for naval warfare, he came to the United States and was engaged by the Lackawanna Railroad to take charge of the cabinet work department in its car shops in Scranton, Pa. He retired 15 years ago.

MR. H. C. ROBINSON.—Heber C. Robinson, sixty-five years old, and one of the best known residents of Camden, N. J., died suddenly at his home from heart disease. Mr. Robinson was an expert electrician and telegrapher, and at the outbreak of the civil war became one of the corps of war operators. After the second battle of Bull Run he telegraphed the first message ever sent from a balloon. He served throughout the war and settled in Philadelphia. He was the manager there of the Western Union Telegraph Company, a member of the select council and active in politics. He moved to Camden about twenty-five years ago and built the first electric light plant in this city, now owned by the Public Service Corporation. He was also largely interested in other lighting plants, and at the time of his death was superintendent of the Egg Harbor City Company's plant. He leaves one son, City Councilman Frank Neall Robinson, and two married daughters.

MR. GUTHRIE GRAY.—The death of Mr. Guthrie Gray, at Muskoka Lake, on August 26th, has cut short at the early age of thirty-one years, the career of one whose future was full of promise. Mr. Gray was graduated from the Lawrence Scientific School of Harvard University in the class of 1896, and was an electrical engineer of more than ordinary ability. After his graduation, he was for a number of years employed in the engineering department of the Buffalo General Electric Company, whose employ he left to accept a position under Mr. Henry Rustin, the superintending engineer in charge of the extensive lighting systems of the Pan American and St. Louis Expositions. For the past two years Mr. Gray was employed in the engineering department of the National Battery Company of Buffalo, N. Y., and in the short time that he had been connected with this company, his energetic work and cheerful disposition gained him the high esteem of the management and his business associates. Mr. Gray was a member of the American Institute of Electricrical Engineers.

Personal.

H. F. J. PORTER.

MR. H. F. J. PORTER is the eldest son of the late Gen. Fitz John Porter. He was born in New York City in 1858, and was educated at St. Paul's School and Lehigh University. After graduating at Lehigh as mechanical engineer in 1878, he spent four years in the shops of the Delamater Iron Works, 13th St. and North River, New York City, passing in succession through the pattern shop, foundry, machine shop and draughting room. While in the machine shop he was sent with two other men to John Roach's yard at Chester, Pa., to supervise the installation in a ship built there of the engines which he had helped to erect in the shops. He was two years with Cooper Hewitt & Company as assistant engineer of their rolling mills at Trenton, N. J. He was next called to Columbia College, then removed to its site at 49th Street and Madison Avenue, to install the power plant, together with the lighting, heating and ventilating system. At this time electric lighting was in its infancy, and the lighting plant of two Edison 100-light dynamos was considered a very large installation. After this was finished, the position of superintendent of buildings and grounds was established and Mr. Porter was made the first incumbent. He inaugurated the system which has since been continued and developed of performing all the repairs to the buildings, furniture and fixtures that are required. In this connection, when the electrical engineering department was established he designed the building for housing it and included in it his repair department, consisting of a machine shop and plumbing department, a carpenter shop and paint shop and an upholsterer shop. In 1890 he accepted the position of engineer and superintendent of the steel spring and wire mill of Cary & Moen, in New York City, and here, after a careful study of the methods of cost accounting then evolved by Mr. Chas. R. Towne at the works of the Yale & Towne Manufacturing Company, introduced a system modified to meet the requirements of the situation, and gave to the company its first clear idea of what its product was costing. The following year he was offered by Mr. D. H. Burnham the position of assistant mechanical engineer of the World's Columbian Exposition at Chicago. He designed and installed the power plant which furnished light and power and water for fire protection to the buildings and grounds during the construction period and was then transferred to the machinery department, where, as assistant chief, he had charge of Machinery Hall and the installation of exhibits. After the close of the Exposition, Mr. Porter opened an office as consulting and contracting engineer, and installed several electric lighting and street railway plants in the vicinity of Chicago. At the same time the Bethlehem Iron Company, which had recently completed their new steel plant for the manufacture of armor plate and guns, desiring to enter the commercial field with their high-grade forgings, engaged Mr. Porter to represent their interests in the West. Finding that the market was not prepared to supplant cheap wrought iron with high-priced steel, Mr. Porter inaugurated a campaign of education, emto technical societies and magazine aricles, which soon brought about a recognition of the merits of his product. This idea of having a practical manufacturer lecture to students regarding his specialty, though new at the time, has since been adopted by many colleges as of great practical benefit in their courses. Mr. Porter introduced hollow-forged steel-engine shafts into power plants, especially large pumping stations and street railway plants, and made possible the large units which now are installed in Chicago, New York, Boston and other principal cities in the country. He also introduced nickel steel in steam-railway work for locomotive forgings, and his work in exploiting this metal succeeded in introducing it in stern-wheel steamer shafts in the rivers of the Middle West and the extreme Northwest, and in such vessels as composed the ore fleets of Rockfeller and others on the Great Lakes. In 1902, when the U. S. Shipbuilding merger, involving the Bethlehem Steel Company, took place, Mr. Porter accepted an invitation by Mr. Westinghouse to take the management of the American branch of the Westinghouse Companies' Publishing Department at Pittsburg. After a year in this department, Mr. Westinghouse made Mr. Porter second vice-president of the Nernst Lamp Company, with the duties of general manager. Within six months after Mr. Porter took hold, he had helped to perfect the details of the lamp and by his methods of marketing, its standing in the lighting field was changed so that to-day it ranks high among electrical illuminants in regard to light efficiency. Mr. Porter's experience has been wide and varied, but constructive and managerial in its nature. His associations have been such that he has had opportunities to observe and put into practice methods which have proved effective in securing results. He has now opened an office in the Metropolitan Building, 1 Madison Avenue, New York, for a consulting industrial engineering practice, installing modern methods of organization and management, leaning towards industrial betterment and including welfare work, which is now recognized as the trend which is taking place in industrial enterprises not only on account of its being morally right, but because it pays in dollars and cents. There are many concerns who desire to treat their employees more like human beings than machines, recognizing the value of taking advantage of the intelligence they possess, but they do not understand just how to go about effecting the change from old methods. There are very few men in the country who have had experience along these lines, and the demand is increasing for experts who can bring about the results desired by the methods which have been proven effective and which are not either sentimental or expensive.

CAPT. HENRY GROVER, of Lynn, Mass., has resigned as superintendent of the Chelsea division of the Lynn & Boston Railroad. Captain Grover's successor is Mr. George H. Gray, hitherto superintendent of the Woburn division of the road.

MR. H. S. RYKERT, dispatcher for the Aurora, Elgin & Chicago Railway Company, has been appointed superintendent of transportation of the Rockford & Interurban Railway Company, of Rockford, Ill. He was for several years connected with the operating department of the Brooklyn Rapid Transit Company.

MR. G. R. FOLDS.—Officials of the Brooklyn Rapid Transit Company gave a dinner on August 29 at the Clarendon Hotel, Brooklyn, to George R. Folds, Assistant General Manager, who has severed his connection with that corporation. Mr. Folds goes to Chicago to become General Manager of the South Side Electric Railroad Company. General Superintendent Dow S. Smith presided at the dinner.

MR. JOHN T. YOUNG has been appointed manager of the Muskegon Lighting & Traction Company to succeed Samuel A. Freshney, who goes to Grand Rapids September 1, to assume the management of the public service department of that city. Mr. Young goes to Muskegon from Akron, Ohio, where he had been in charge of the mechanical and electrical department of the Cleveland Construction Company the past 12 years, during which he has been superintendent of construction work for the company in Ohio, Illinois, Indiana and New York.

MR. J. C. COLLINS has been elected secretary and assistant treasurer of the Rochester Railway Company, of Rochester, N. Y., vice Mr. Geo. G. Morehouse, resigned. Previous to entering the street railway field Mr. Collins was in the employ of the accounting department of the Norfolk & Western Railroad. When E. W. Clark & Company, of Philadelphia, purchased the Chester Traction Company Mr. Collins was appointed to the position of chief clerk and remained in that capacity until just previous to the time of the sale of the road by them. He next filled the position of assistant secretary of the Camden & Suburban Railway Company, with which he remained four years. Entering the employ of E. W. Clark & Company as one of its railway auditors, Mr. Collins remained with the firm until his appointment as chief clerk of the Rochester Railway Company on July 1, 1904.

KING, HODENPYL & CO.—The firm of King, Hodenpyl & Co. was dissolved Sept. 1, Anton G. Hodenpyl retiring. The business will be continued by John C. King, O. E. Babcock, E. Beranek, J. A. Rushton and W. J. Louderback, under the firm name of John C. King & Co., at the Rookery Building, Chicago, Ill., and 7 Wall Street, New York. The firm of Hodenpyl, Walbridge & Co. is largely interested in street railway and lighting properties in Rochester, N. Y.; Springfield, Ill.; Saginaw, Bay City, Kalamazoo, Jackson and Pontiac, Mich., and the dissolution is a simple separation of the two branches of the business, Mr. Hodenpyl retaining his interest in Hodenpyl, Walbridge & Co., and Messrs. King and Babcock withdrawing from that firm. The joint offices will still be maintained at 7 Wall Street, New York, by John C. King & Co. and Hodenpyl, Walbridge & Co.

MR. LEAVENWORTH WHEELER, who has been superintendent of the Worcester & Southbridge Street Railway since its opening, severed his connection with the company Aug. 20, and has assumed new duties in Pittsfield as superintendent of another and larger division of the Consolidated Railway Company, viz., the Berkshire Street Railway. The appointment of Mr. Wheeler to the new position with its added responsibilites was in recognition of his able management of the Worcester & Southbridge property. Mr. Wheeler was considerably surprised to find on entering his office at Pittsfield to take up his duties as superintendent a quartered-oak roll-top desk as a gift from the employes of the Worcester & Southbridge and the Southbridge & Sturbridge Street Railways. Mr. J. B. Potter, of Webster, superintendent of the Worcester & Connecticut Eastern Division of the Consolidated Railway Company, has been appointed Superintendent of these lines.

MR. SAMUEL A. FRESHNEY has resigned as manager of the Muskegon, Mich., Light & Traction Company to accept the position of manager of the Grand Rapids, Mich., public utility service. He will have charge and management of the lighting plant, water works, garbage burner, street and other public works. The position is created by the new city charter and carries a salary of $4,000. On Monday evening, Aug. 21, Mr. Freshney was tendered a banquet by his Muskegon associates. After the last car was in the barns at midnight a special train was made up to run to Lake Michigan Park, on the shores of the lake. Here, in an elaborately lighted pavilion, covers were laid for 96. At the head of the table over Mr. Freshney's head swayed a big bell and a car searchlight threw a beam on the table. At the head of the table with Mr. Freshney were seated the stockholders and officers of the traction company, Mr. John T. Young, his successors, and the others of the company. F. A. Nims was toastmaster and speeches were made by Representative Jerome E. Turner, C. W. Sessions—who presented to Mr. Freshney a silver loving cup—Mr. Freshney, Mr. Young, Superintendent Girdler, Train Dispatcher Percy M. Pett and other employes of the company.

Trade Publications.

SMELTING MACHINERY.—The Allis-Chalmers Company, Milwaukee, Wis., has issued catalogue No. 122, which, in addition to describing smelting furnaces and accessory equipment, deals with the metallurgical processes in an instructive manner, so that the catalogue forms a valuable reference book on smelting.

BENJAMIN CATALOGUE.—A new catalogue will be issued by the Benjamin Electric Manufacturing Company, 42 West Jackson Boulevard, Chicago, Ill., which will be ready about October 1. This will be a new edition and a much larger publication than heretofore. A number of new specialties will

be listed and it is expected that the catalogue will meet every requirement of electric lighting work.

ELECTRIC POWER IN FACTORIES.—The Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., has issued as bulletin No. 144 a reprint of an article by A. W. Henshaw, on "Electric Power in Factories," which appeared in the ELECTRICAL WORLD AND ENGINEER, March 18, 1905. The bulletin is well illustrated, views being given of the various types of S. K. C. apparatus suitable for factory service.

SMALL DIRECT-CURRENT MOTORS.—Bulletin No. 60 of the Crocker-Wheeler Company, Ampere, N. J., is devoted to a line of direct-current motors built to give outputs ranging from one-quarter to three horse-power. These motors are fitted with end shields, which permit their being made dust-proof, and they are adapted for either wall or ceiling suspension. The bulletin shows the constructional features of the machines, and describes the service tests to which they are subjected. Numerous illustrations are given to show the uses to which these motors can be put.

THE WARD LEONARD ELECTRIC COMPANY, of Bronxville, N. Y., is about to issue a new catalogue, bulletin No. 19051, covering motor-speed controllers for ventilating fan duty. This bulletin shows cuts, diagrams of all internal connections of these controllers, tables of resistance, capacities, etc. One sheet is devoted exclusively to specifications. These controllers have an interlocking overload circuit breaker, no-voltage release, renewable segments, self-aligning renewable skate-shoe contacts, independent make and quick break device which prevents arcing upon the first contact, etc.

STEAM SPECIALTIES.—The Williams Gauge Company, 543 Fourth Ave., Pittsburg, Pa., is issuing some interesting literature devoted to its steam specialties, including safety feed-water regulators, auxiliary feed-water regulators, high-pressure steam traps, steam-pump governors, safety water columns, chain-lever water gauges and rotating regrinding gauge cocks. Numerous illustrations are given of steam plants where these devices are in use, while a booklet filled with copies of letters from various users serves to show that the specialties have given excellent satisfaction in actual service.

AT THE GATEWAY OF THE MOHAWK.—An attractive pamphlet having the above title has recently been issued by the Schenectady Railway Company, Schenectady, N. Y. The pamphlet is profusely illustrated, and serves to show the beauties of the country traversed by the lines of the company. An interesting group of photographs shows the various stages in the development of the passenger traffic. Views are shown of the old horse car, the small electric street car, the heavy interurban car, the combined direct and alternating-current car and the modern electric locomotive for passenger service.

CRANE MOTORS.—In bulletin No. 223, just issued by the Sprague Electric Company, 527 West 34th Street, New York, are described type N motors, which are direct-current, series-wound machines specially designed for electric crane service. The field frames are rectangular in form without joints of any kind. The ends of the field frame are formed by two bearing shields which support the armature and render the motor dust-proof. The field coils are assembled on the pole pieces on the workmen's benches. After being assembled on the pole pieces, the completed field magnets are installed in the frame and locked into place.

GOULDS PUMPS.—In a well-illustrated catalogue of 192 pages, the Goulds Manufacturing Company, Seneca Falls, N. Y., discusses the constructional features and operating characteristics of the Goulds pumps. It is interesting to observe that most of the pumps are arranged for driving by means of electric motors, several being of the direct-connected type, others of the chain or belt-driven type. A complete line of starters and regulators for the motor-driven pumps is also described. Views are given of the shops where the pumps are made, and numerous illustrations serve to show some of the installations in which the pumps are used.

FUSES.—The H. W. Johns-Manville Company, 100 William Street, New York, has issued a series of three catalogues devoted to a complete line of fuse devices suitable for all voltages. Perhaps the most interesting of these catalogues is the one dealing with fuses for 1,500 to 10,000-volt circuits. The terminal fittings for the 10,000-volt fuses consist of the flat style of contact. The slots in the terminals are at right angles to each other, so that the fuse can be swung out of connection with the contact post. The fuses are of the "Noark" type. The tubes of these fuses are coated with a moisture proofing compound which materially assists in maintaining the tube in a dry condition.

REVERSING CONTROLLERS.—The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has issued Circular No. 1,108, which deals with regulating and reversing controllers for both direct and alternating-current motors. The controllers of the alternating-current type are designed for use with polyphase induction motors and with single-phase commutator motors. The speed of the polyphase motors is varied either by changing the resistance of the secondary circuit or by alternating the voltage impressed upon the primary circuit, while the single-phase motors are controlled in speed by the variation of the resistance in series with the main circuits of the machines.

STEAM ENGINES.—The Ball Engine Company, Erie, Pa., has issued a well-executed booklet, designated as catalogue O, which describes its new line of engines of the side-crank type. The side-crank construction eliminates the necessity for three bearings in engines direct connected to generators. When only two shaft bearings are used, there is no difficulty in preserving the alignment, and it is very easy to test the alignment at any time. The large engines are provided with Corliss valves. It is stated that so perfect is the smoothness of action of these valves that valve gears which have been running for over two years without any adjustments having been made do not make any sound that can be heard five feet away.

HOISTING ENGINES.—In a 78-page catalogue, designated as No. 126, the Allis-Chalmers Company, Milwaukee, Wis., describes numerous styles of hoisting engines and accessories. The hoisting equipments comprise not only the latest and most economical winding plants operated by either steam, electricity, water or air, as local conditions may make desirable, but also single and multi-decked cakes, self-dumping skips for vertical or inclined shafts, timber skips of the latest design, bailing tanks, shaft chairs, cars, buckets, safety detaching hooks, sheave wheels, pneumatically-operated ore gates for loading skips from the shaft pockets according to the latest practice, and everything necessary for the safe and most economical handling of the broken material from the mine to the shipping bins, mill or breaker.

PUMPING ENGINES.—Bulletins Nos. 1600 and 1601 of the Allis-Chalmers Company, Milwaukee, Wis., are devoted to reports of tests of pumping engines. The first of these records the test of one of the 15,000,000-gallon vertical triple-expansion pumping engines installed in the Baden high-service station of the St. Louis, Mo., water works. The mechanical efficiency was found to be 96.84 per cent., and the thermal efficiency 21.0 per cent. The second bulletin reports a test of the 30,000,000-gallon pumping engine installed in the Chestnut Hill high-service station of the Metropolitan Water Works, Boston, Mass. The mechanical efficiency was 93.29 per cent., and the thermal efficiency 21.63 per cent. It is stated that this engine holds the world's record for economy of operation. The test of each engine is described in detail.

THE MOODY PUBLICATIONS.—The Moody Corporation, 35 Nassau Street, New York, has issued a handsome booklet describing its origin, growth and present features. While the only publication issued a few years ago was *Moody's Manual*, the corporation is now issuing no less than four annual reference books, and has also published several other volumes of an economic and financial nature. In addition to the Manual there are issued the Moody's Coupon and Dividend Directory, Moody's Classified Investments and Moody's Municipal Year Book. The last is a new annual volume, now in preparation, the first edition of which will be ready early in 1906. Another annual publication shortly to make its appearance will be Moody's Quotation Record. The organization of the publishing, statistical and printing departments is described in detail.

WAINWRIGHT SPECIALTIES.—Mr. W. R. Billings, Taunton, Mass., has issued the following notice to the trade: "For the past ten years the Wainwright feed-water heaters, Dean reheaters, surface condensers, expansion joints, heat extractors, and air coolers have been made in the shops of the Taunton Locomotive Manufacturing Company, of Taunton, Mass. After an honorable and successful career of nearly sixty years, and while in a thoroughly sound condition, the Taunton company has decided to go into voluntary liquidation. During his term of service as treasurer and general manager, the undersigned was fortunate enough to secure for the Taunton company the Wainwright business, then in its infancy, and for the past ten years he has devoted much time and thought to the development of the possibilities of the Wainwright corrugated tube. The liquidation of the Taunton company has afforded an opportunity, of which the undersigned has gladly availed himself, to purchase from the Wainwright Manufacturing Company, of Massachusetts, the patents, name and good will, and from the Taunton company the drawings, patterns and special tools necessary for a continuation of the Wainwright business. On and after Sept. 1, 1905, the business will be taken up and carried on under the direction of the undersigned, by the Alberger Condenser Company, of New York. Under these circumstances it goes without saying that the high quality of the Wainwright appliances will be maintained. Further announcements concerning the arrangements here referred to will be made in due time by the Alberger Company."

News of the Trade.

VULCAN SOLDERING TOOLS.—F. J. Holmes, of L. P. Brown & Co., 71 West Jackson Boulevard, Chicago, was a visitor to New York last week. The company makes the Vulcan electric soldering tool and Mr. Holmes interviewed one or two people in the East with respect to its merits.

BELT DRIVE.—Recently an erroneous statement was printed in various journals to the effect that suit had been commenced by the "Westinghouse Interests" against the Link-Belt Machinery Company. We are advised that the suit in question was not brought by the Westinghouse interests, but by the Morse Chain Company, of Trumansburg, N. Y., who, on July 27th, filed bill in equity in the United States Circuit Court, Northern District of Illinois, Eastern Division, against the Link-Belt Machinery Company for alleged infringement.

THE STANDARD CHEMICAL COMPANY, of Cincinnati, Ohio, are putting the Imperial soldering paste on the market. This is a preparation that acts quickly and without corrosion, cleaning the parts to be soldered and causing the solder to flow smoothly and evenly. There is nothing in it that is harmful to the clothes or person, so it may be handled with impunity. There is a great demand for good soldering paste, and the manufacturers confidently expect that the user of the Imperial compound will find that it meets every requirement.

THE CHALLENGE MANUFACTURING COMPANY, 365 Market Street, Newark, N. J., are makers of a closed-circuit battery which they have claimed possesses the advantages of maintenance of efficiency throughout its entire life with absolutely no local action or polarization. Besides this the mechanical construction of the cell is such that it permits of renewals in much quicker time. A forceful substantiation of this claim comes from one of the leading railroad companies which has upwards of 20,000 cells on its lines for signal purposes. In a letter written recently to the manufacturer they say that the Challenge battery has been found to be the quickest battery to set up and renew that they have ever used. A testimonial of this sort from one of the largest users of primary batteries gives striking emphasis to the manufacturer's claims.

THE CHICAGO FUSE WIRE & MANUFACTURING COMPANY call attention to the development of their Standard electro-soldering paste. The discovery of this compound dates back to the early nineties, when the company was awarded the contract for fuses for the World's Columbian Exposi-

tion at Chicago. The large quantities required on short notice and the absence of a satisfactory flux caused the copper to corrode and considerable trouble was experienced for a time. The company then secured the services of a noted chemist and a flux was produced which has since played an important part in the manufacture of their well-known "Tested Fuse Links." The vital point so often forgotten in a soldered joint is the necessity of cleaning throughly the entire surface of the parts, especially where full strength or greatest conductivity is required. Mr. Goodman, secretary of the Chicago Fuse Wire & Manufacturing Company, says that many other users have emphasized the need of a really first-class soldering flux, which had no acid base and would not corrode the work, but still would be so quick in its action that the smallest quantity would drive the solder to every part of the joint. These requirements, it is said, are fully realized in Standard electro-soldering paste.

LUBRICANT FOR HOISTING CABLES.—Elevator and other cables used for hoisting purposes, are subject to both internal and external wear; the former is caused by the rubbing of the wires and strands upon one another under pressure in bending over the sheaves, the latter by rubbing and wedging in the grooves of the pulleys. Unless the cables are kept well lubricated they wear and deteriorate rapidly. The Joseph Dixon Crucible Company, Jersey City, N. J., has solved the problem of wire rope lubrication by the use of graphite and now offers to the trade its "Handy Graphite Rope Dressing," concerning which it is now distributing some attractive advertising material in the form of blotters and folders.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

AMERICAN ELECTROCHEMICAL SOCIETY.. Secretary, S. S. Sadtler, 39 S. 10th St., Philadelphia. Next meeting, Bethlehem, Pa., Sept. 18, 19 and 20, 1905.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Conn. Next meeting, New York City, Sept. 19, 20 and 21, 1905.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York. Meetings, last Friday each month.

AMERICAN RAILWAY, MECHANICAL & ELECTRICAL ASSOCIATION. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.. Secretary, G. W. Tillson, Brooklyn, N. Y. Next meeting, Montreal, Can., Sept. 5, 6 and 7, 1905.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Pennington, 2020 State Street, Chicago. Next convention, Philadelphia, last week in September, 1905. Bellevue-Stratford Hotel and Phila. Com. Museum.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. S. Barstow, New York City and Portland, Ore. Hotel Champlain, Clinton County, N. Y., Sept. 12, 13, 14.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION.. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, George B. Tripp, Colorado Springs, Col. Next meeting, Glenwood Springs, Col., Sept. 18, 19 and 20, 1905.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ELECTRICAL ASSOCIATION OF NORTH DAKOTA. Secretary, S. J. Fuller, Larimore, N. D.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, F. Fish, Rochester, N. Y. Next meeting, Buffalo, Jan. 16, 1906.

ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, D. Davis, Litchfield, Ill. Next meeting, Peoria, Oct. 5 and 6, 1905.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Annual meeting, second Thursday in January, 1906. Monthly meetings, second Thursday of each month.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

IOWA ELECTRICAL ASSOCIATION. Secretary, P. E. Bellamy, Knoxville, Ill. Next meeting, Des Moines.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, second Tuesday in March, 1906.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION.. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Kansas City, Oct. 14 and 15, 1905.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION.. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Detroit, Oct. 10, 1905.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary Frank S. Leach, Sedalia, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind. Next meeting, Baltimore, Md., October, 1905.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y.

NATIONAL INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Laue, 12 Pearl Street, Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis. Next meeting, Milwaukee, Wis., third Wednesday in Jan., 1906.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Elmira, N. Y., June, 1906.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, C. J. Miller, 620 Shorb Street, Canton, Ohio.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION.. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa. Next meeting, Pittsburg, September, 1905.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, second Tuesday in May, 1906.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, H. B. Hartwell, Irene, S. D. Next annual convention, Sioux Falls, S. D., second Wednesday in January, 1906.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, W. B. Brockway, 40 Morris Street, Yonkers, N. Y.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. B. Fairchild, jr., 114 Liberty St., New York.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STREET RAILWAY & ELECTRIC ASSOCIATION. President, R. D. Apperson, 723 Main St., Lynchburg, Va.

WESTERN SOCIETY OF ENGINEERS, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUGUST 22, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

797,561. TELEPHONE HOOK-SWITCH; Josephus McKinley Clement, Mineralbluff, Ga. App. filed Mar. 8, 1905.

797,570. MULTIPLEX TELEGRAPH SYSTEM; Tullio Giara, Boston, Mass. App. filed July 5, 1904. A printing telegraph having a plurality of typewriter keyboards at each end of the line, and corresponding receiving apparatus. Employs synchronously rotating contacts.

797,586. TELEPHONE SYSTEM; Edmund Land, Grand Rapids, Mich. App. filed Nov. 2, 1904.

797,589. ELECTRIC CAR OR LOCOMOTIVE; Nils D. Levin, Chicago, Ill. App. filed Apr. 22, 1904. In order to permit the operation of electric trucks at a distance from the regular trolley line, the truck has a spring drum with a flexible cable extending therefrom. In order to increase the radius of action, the spring drum is formed with a series of helical springs arranged in parallel layers.

797,591. ELECTRICAL RAILWAY SIGNALING SYSTEM; Leonidas N. Lyon, Jr., Flatonia, Tex. App. filed Nov. 29, 1904. A pair of conductors are arranged adjacent to the ordinary track rails and depending trolleys upon the train make a circuit therewith. When the train passes over any section, an electro-magnet is energized which completes a talking or telegraph circuit to a neighboring train.

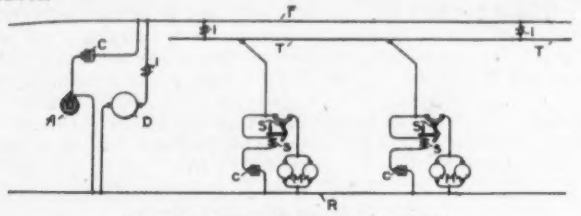
797,593. INCANDESCENT LAMP; Albert W. W. Miller, South Orange, N. J. App. filed Sept. 3, 1903. The lamp is formed with a straight narrow neck portion which may be cut to permit a new filament to be inserted, or the lamp otherwise repaired. The contact sleeve is quite short and has certain special features of construction.

797,612. TELEGRAPH KEY; William H. Schermerhorn, Ree Heights, S. D. App. filed Feb. 24, 1905. In order to insure the usual circuit closing switch of a telegraph key from being left open, the patentee provides an annular button surrounding the usual key which controls the switch. The button is designed to be held depressed by the hand of the operator.

797,628. ELECTROMAGNETIC COMPENSATING DEVICE; Bernard A. Stowe, Cleveland, O. App. filed May 24, 1904. For the purpose of compensating for the decreasing permeability of an electro-magnet when the latter becomes warm under excessive current, the patentee arranges his magnetic circuit so that the latter becomes closed as its temperature rises.

797,629. ELECTRIC ARC LAMP; Bernard A. Stowe, Cleveland, O. App. filed May 25, 1904. In order to avoid the escape of the hot gases from within an enclosed arc chamber under the action of "breathing," the gases are made to pass through a long pipe or duct having an attenuated portion where it enters the arc chamber.

797,669. TROLLEY WIRE REPAIR DEVICE; Hermann Dems, Chicago, Ill. App. filed Nov. 11, 1904. A metal basket has a pair of gripping jaws at each end which may grip the trolley wire sections and draw them together over the basket. The wire is now in position to be conveniently repaired.



797,863.—Syntonic Signaling System.

797,678. ELECTRIC RAILWAY SIGNAL; Jake Friedlander, Fargo, N. D. App. filed Dec. 27, 1904. At convenient points along the track a contact plate is located beneath the usual rail in such a way that the weight of the train will establish contact therewith. In this way a telephone or telegraph circuit is completed from the train to the train despatcher's office.

797,679. CIRCUIT CLOSER; Jake Friedlander, Fargo, N. D. App. filed Mar. 20, 1905. A thermostat circuit closer in which a thermometer tube is left open at the top and a metallic plunger located therein is pressed upward to make a contact when the mercury rises. Contact can also be made by a push button.

797,699. INCANDESCENT LAMP SOCKET; Norman Marshall, Newton, Mass. App. filed Jan. 21, 1904. The socket has a cord which may be pulled to throw a switch into either its on or off position. The cord is alternately effective to release a detent and allow a spring to throw the switch, and to positively draw the switch back into engagement with the detent.

797,713. AUTOMATIC FIRE-ALARM; Karl J. Backman, Karlsvik, Forshaga, Sweden. App. filed Feb. 7, 1905. A thermostat cut-out in which spring-pressed contacts are normally separated by a plug of wax or sulphur or other fusible substance which may melt and allow the contacts to approach one another.

797,718. PORTABLE X-RAY APPARATUS; Eugene W. Caldwell, New York, N. Y. App. filed Aug. 18, 1904. The spark gap is formed by a series of buttons supported on metallic rods. The buttons are arranged to be vibrated for the purpose of varying the spark gap.

797,720. TROLLEY; Henry B. Clarke, Chicago, Ill. App. filed Feb. 26, 1904. The trolley wheel has two deep grooves at each side thereof into which the wire falls when the wheel leaves the same. Spiral conducting grooves lead the trolley back onto the central wheel.

797,747. ELECTRIC FURNACE; Henry Noel Potter, New Rochelle, N. Y. App. filed July 23, 1903. (See page 395.)

797,761. COMPOSITE TELEGRAPH AND TELEPHONE SYTEM; Carlo Turchi, Ferrara, Italy. App. filed Nov. 12, 1903.

797,774. SYSTEM OF MOTOR CONTROL; Charles E. Lord, Cincinnati, O. App. filed Apr. 12, 1905. A pair of pneumatic train pipes extend throughout the length of the train and have connections with motor controlling contacts on each car.

797,783. RAILWAY SIGNAL; Vibe K. Spicer, Kenilworth, Ill. App. filed Sept. 12, 1902. The semaphore arm is raised by a mechanical connection extending into the path of projections on an endless belt. The belt is driven from an electric motor and automatically breaks the motor circuit after a pre-determined movement.

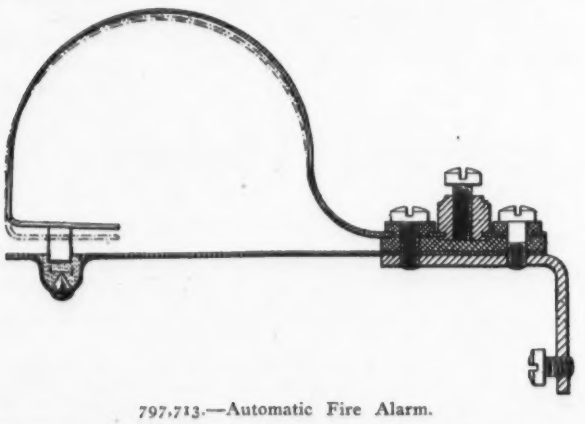
797,787. NEGATIVE ELECTRODE FOR PRIMARY BATTERIES; David L. Winters, Chicago, Ill. App. filed Jan. 30, 1905. (See page 395.)

797,806. ARC LAMP HANGER AND CUT-OUT; Charles E. Harthan, Lynn, Mass. App. filed Apr. 29, 1903. An arc lamp cut-out adapted for high potential circuits. The elements of the cut-out are enclosed within a shell or canopy supported from an insulator above the lamp so as to be protected from the weather. A form of snap switch is used embodying a gear with a certain amount of lost motion.

797,811. WATCH DEMAGNETIZER; Patrick Kerns, Chicago, Ill. App. filed Mar. 9, 1903. A pole changer in which space contacts around the periphery of a drum make alternate connections with a pair of brushes. The current is supplied through a grounded connection and a concentric ring.

797,825. ELECTRIC LAMP SOCKET; Albert P. Seymour, Syracuse, N. Y. App. filed Apr. 27, 1904. In order to secure a more efficient protection against fire, the lamp socket is made of porcelain having two halves with a central cavity. The switch mechanism is located entirely in the central cavity.

797,845. SHEET METAL FOR PERFORATED POCKETS OF STORAGE BATTERIES; Thomas A. Edison, Orange, N. J. App. filed July 21, 1904. (See page 395.)



797,713.—Automatic Fire Alarm.

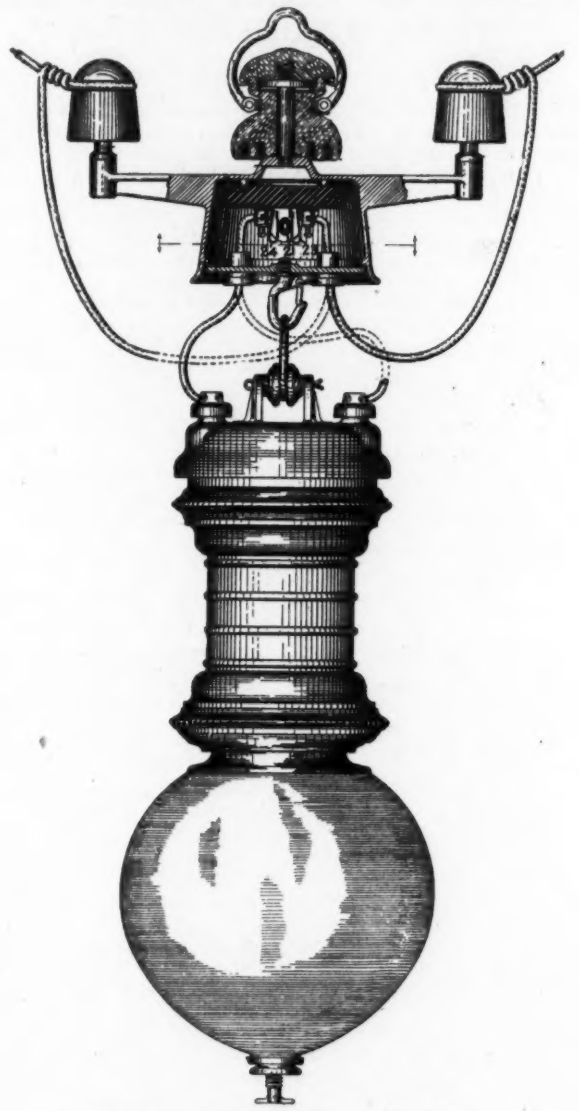
797,859. TRAIN CONTROL SYSTEM; Charles E. Lord, Cincinnati, O. App. filed Jan. 27, 1905. Relates to means of cutting out motor resistances in succession and at the proper rate for efficient starting speed of trains by pneumatic operating arrangement involving two train pipes.

797,860. TRAIN CONTROL SYSTEM; Charles E. Lord, Cincinnati, O. App. filed Jan. 27, 1905. Relates to modifications of the above and particularly to the construction of the controller parts whereby a minimum number of contacts is secured.

797,863. SYNTONIC SIGNALING SYSTEM; Maurice Milch, Schenectady, N. Y. App. filed March 30, 1904. A signaling circuit is arranged in synchronism with a high frequency alternating power circuit, in such a way that when a single car is on a block the circuits are properly in rhythm, but when the second car enters the block, the synchronism is destroyed and a warning signal is given.

797,868. TRANSFORMER; Edwin W. Rice, Jr., Schenectady, N. Y. App. filed Apr. 4, 1904. In order to prevent the destruction of air-cooled transformers by the circulation of air through the ventilating openings during a fire, valves are normally held open by destructible devices and automatically closed in case of fire.

797,889. CONTROLLING ELECTRIC MOTORS; William Geipel, Frederick M. T. Lange, London, and George W. Mascord, Barnes, England. App. filed Nov. 28, 1904. A method of controlling shunt-wound electric motors partially driven by a motor generator. The generator which supplies only a portion of the power, at times assists and at other times opposes the armature windings of the motor.



797,806.—Arc Lamp Hanger and Cut-Out.

797,907. FIRE ALARM SYSTEM; Judson McFell, Chicago, Ill. App. filed May 27, 1904. In order to secure the advantages of a closed circuit fire alarm system in an open circuit, the patentee provides an open circuit apparatus, but in which a test circuit is constantly effective to indicate a break in the signal circuit.

797,917. ELECTRICAL METER; Henry W. Sayles, Peoria, Ill. App. filed March 13, 1905. For the purpose of compensating for the starting inertia of the moving parts in a Watt meter, an auxiliary field coil is provided which is adjustable into various positions with respect to the stationary field coil.

797,979. LIGHTING DEVICE; Thomas S. Sayre, Cape May, N. J. App. filed March 8, 1905. A cigar lighter in which the wick tube is normally closed by a hinged cap. When the cap is swung upward to expose the wick a contact is made for igniting the latter.

797,993. AUTOMATIC REGULATOR FOR ELECTRIC CIRCUITS; Montgomery Waddell, New York, N. Y. App. filed June 28, 1904. The field magnet coils are provided with two separate windings which oppose one another. Each of the windings is in series with a separate resistance which is automatically regulated by a solenoid.

798,008. TELEGRAPH APPARATUS; Henry C. Braun, Barnet, England. App. filed June 20, 1904. A fac-simile telegraph apparatus in which a pair of pendulums at the transmitting and receiving stations swing synchronously by electrical means. When the pendulum at the transmitting station swings over an uninsulated point on the picture, a momentary current is transmitted which depresses the stylus at the receiving station.

798,035. TELEPHONE SYSTEM; Calvin R. Green and David R. Green, Risingsun, Ind. App. filed Dec. 20, 1904.

798,038. APPARATUS FOR ELECTRICAL REGULATION; Albert S. Hubbard, Greenwich, Conn. App. filed June 17, 1904. A system for regulating the voltage of street railway installations involving the use of boosters, storage batteries and regulating resistances.